ART AND SCIENCE OF SAILMAKING

SAMUEL B. SADLER

Cornell University Library

BOUGHT WITH THE INCOME
FROM THE
SAGE ENDOWMENT FUND
THE GIFT OF
Henry W. Sage
1891

A.207139 .... 1/11/1906

5901

Cornell University Library
VM532 .S12 1906

The art and science of sailmaking.

3 1924 030 902 765

olin

Cornell University Library

The original of this book is in
the Cornell University Library.

There are no known copyright restrictions in
the United States on the use of the text.

http://www.archive.org/details/cu31924030902765

THE
ART AND SCIENCE OF SAILMAKING

THE
ART AND SCIENCE
OF
SAILMAKING

BY

SAMUEL B. SADLER

PRACTICAL SAILMAKER, BURNHAM-ON-CROUCH

(*Late in the employment of* RATSEY AND LAPTHORNE, *of Cowes and Gosport*)

SECOND EDITION, WITH AN ADDITIONAL CHAPTER

LONDON
CROSBY LOCKWOOD AND SON
7, STATIONERS' HALL COURT, LUDGATE HILL
1906

D

PREFACE.

The Author of this work is sanguine that it will meet with a favourable reception, not only by the Sailmaker, but also by those who use sails, as no book has hitherto been published, to his knowledge, which deals with the subject of Sailmaking in a really scientific manner.

He is convinced that no manufacture can be successfully carried on without fixed principles or methods to guide the workman. That art and science are *required* in Sailmaking is evident from the fact that a sail, after it has been in use for a time, should compare favourably in every detail with the plan and specification given to the maker, and have all the qualities of a flat and *lifting* sail. The Author uses the word "lifting" advisedly, as it is a most important and, indeed, essential feature in a fore and aft sail that it be a help in *lifting* the vessel out of the trough of the sea, and keep her free and lively upon the surface. He does not hesitate to add that, in his belief, many vessels, more especially fishing smacks, are lost, and numbers of lives sacrificed annually, in consequence of baggy sails, which during a gale hold the wind and press the vessels down, there being no freedom for the wind's exit out of the after-leech.

If the publication of this treatise should only be the means of reducing this loss of life and property, the Author will consider himself amply repaid for the time and labour expended upon it. He has given years of careful observation and study to the work of sailmaking, and has been in the employment of the best sailmakers in the kingdom; and he is thus enabled, he believes, to set before anyone who brings intelligence to his work principles by which can be produced flat and lifting sails of whatever description, second to the productions of no maker in the trade.

He has not forgotten a remark made to him many years ago by the first foreman of the most famous yacht sailmaking firm in this country—perhaps in the world—as to the secret of that firm's success, which was to the effect that their success was owing to "attention given to apparent trifles." This treatise, he believes, will be found to practically demonstrate the truth of that assertion.

The work is so arranged that the several operations of Sailmaking are treated consecutively, with distinctive heads, under each chapter; and the Author confidently believes that, while a careful perusal of its pages will be as a revelation to many, it will confer a lasting benefit upon a numerous class who have felt the want of a handbook of the kind in the prosecution of their calling.

BURNHAM-ON-CROUCH, ESSEX,
June, 1892.

NOTE TO SECOND EDITION.

A NEW edition being called for, the Author gladly takes the opportunity of expressing his grateful thanks for the favourable reception accorded to this work, and his satisfaction that its trustworthiness and accuracy in detail have been verified in practice.

A new chapter (being Chapter XI. of this edition) has now been added.

BURNHAM-ON-CROUCH,
June, 1906.

CONTENTS.

CHAPTER I.

THE MATERIALS USED AND THEIR RELATION TO SAILS.

PAGE

Stretching Tendency of Sailcloth—Selecting Sailcloth—What to do in case of a Slack Selvage—The Best Sailcloth—Tables of Sailcloth—The Best Bolt Rope—Its Flexibility—Tables of Bolt Rope . . . 1—8

CHAPTER II.

ON THE CENTRE OF EFFORT.

Importance of Finding Position of Centre of Gravity—To Find the Centre of Effort—Treatment of Slack Seams—Drawings . . . 9—11

CHAPTER III.

ON MEASURING.

Vessels to be Measured when Afloat—Importance of knowing exact Stand of Masts—Spars to be Measured to their full Extent—To get Dimensions for Sails—Sheets determined when set off upon Paper—To get Dimensions for Single Sails . . . . 12—14

CHAPTER IV.

ON DRAWING.

Drawings should be Based upon a Square—Care to be exercised in Squaring Off Sails—Geometrical Drawings of Cutter Yacht's Mainsail (Round Foot), Cutter Yacht's Mainsail (Laced Foot), Yawl Yacht's Mainsail, Barge's Sprit Mainsail, Yacht's Stay Foresail, Jib (Ordinary-Cut), Jib (Diagonal-Cut), Yard Topsail, Jib-Headed Topsail, Barge's Topsail, Balance Lug and Lug Sail . . . . 15—20

CHAPTER V.

ON THE NUMBER OF CLOTHS REQUIRED.

PAGE

Calculation showing the Number of Cloths required for Head and Foot of Cutter Yacht's Mainsail—To Find Number of Cloths for a Triangular Sail —Drawing of Jib showing Method of Getting the same . 21—27

CHAPTER VI.

ON ALLOWANCES.

Quotation from Kipping's Treatise on "Sails and Sailmaking"—Allowances for Cutter Yacht's Mainsail (Round Foot), Cutter Yacht's Mainsail (Laced Foot), Yawl Yacht's Mainsail, Barge's Sprit Mainsail, Yacht's Stay Foresail, Jib (Ordinary-Cut), Jib (Diagonal-Cut), Yard Topsail, Jib-Headed Topsail, Barge's Topsail, Balance Lug and Lug Sail . . . . 28—58

CHAPTER VII.

CALCULATION OF GORES.

Best Way of Calculating Gores—Calculation of Gores for Cutter Yacht's Mainsail (Round Foot), Cutter Yacht's Mainsail (Laced Foot), Yawl Yacht's Mainsail, Barge's Sprit Mainsail, Yacht's Stay Foresail, Jib (Ordinary-Cut), Jib (Diagonal-Cut), Yard Topsail, Jib-Headed Topsail, Barge's Topsail, Balance Lug and Lug Sail . . . . 59—78

CHAPTER VIII.

ON CUTTING OUT.

Where to Commence to Cut Out a Mainsail—Drawing showing a Method of Marking Gores—Figures for Cutting Out Cutter Yacht's Mainsail (Round Foot), Cutter Yacht's Mainsail (Laced Foot), Yawl Yacht's Mainsail, Barge's Sprit Mainsail, Yacht's Stay Foresail, Jib (Ordinary-Cut), Jib (Diagonal-Cut), Yard Topsail, Jib-Headed Topsail, Barge's Topsail, Balance Lug and Lug Sail . . . . 79—100

CHAPTER IX.

ON ROPING.

Importance of adjusting Rope to Strain Applied—Treatment of Rope—Roping of Cutter Yacht's Mainsail (Round Foot), Cutter Yacht's

PAGE

Mainsail (Laced Foot), Yawl Yacht's Mainsail, Barge's Sprit Mainsail, Yacht's Stay Foresail, Jib (Ordinary-Cut), Jib (Diagonal-Cut), Yard Topsail, Jib-Headed Topsail, Barge's Topsail, Balance Lug and Lug Sail . 101—111

CHAPTER X.

ON DIAGONAL-CUT SAILS.

Remarks upon Cutter and Yawl or Ketch's Mainsails, Foresail, Jib-Headed and Yard Topsails and Jib—Number of Cloths Required—Allowances—Calculation of Gores—Cutting Out and Roping of same . 112—134

CHAPTER XI.

ON HORIZONTAL-CUT SAILS.

Cutters, Mainsail and Foresail—Calculation of Gores—Necessary Allowances—Roping, &c.—Remarks thereon . . . . 135—138

CHAPTER XII.

CONCLUDING REMARKS.

Need of Care in the Manufacture of Sails—Good Workmanship Essential—Creasing Wide Seams—Proportion of Allowances—The "Science" and "Art" of Sailmaking 139-141

LIST OF ILLUSTRATIONS.

Fig. *Facing page*
1. Jib-Headed Topsail: Triangular Sail, showing Method of Finding Centre of Effort 10
2. Fore and Aft Mainsail: Showing Method of Finding Centre of Effort and Position of Slack Seams 10
3. Cutter Yacht's Mainsail: Giving Length of Gores, &c. ... ...
4. Cutter Yacht's Mainsail (Laced Foot): Giving Length of Gores, &c. ...
5. Yawl Yacht's Mainsail: Giving Length of Gores, &c. ... ...
6. Barge's Sprit Mainsail: Giving Length of Gores, &c. ... ...
7. Yacht's Stay Foresail: Giving Length of Gores, &c. ... ...
8. Jib (Ordinary-Cut): Giving Length of Foot Gore and Allowances ... ...
9. Jib (Diagonal-Cut): Showing Method of Finding Amount of Last Gore Required, Allowances, &c. 20
10. Yacht's Yard Topsail: Giving Length of Gores, &c... ... ...
11. Yacht's Jib-Headed Topsail: Giving Length of Gores, &c... ... ...
12. Barge's Topsail: Giving Length of Gores, &c. ... ...
13. Balance Lug: Giving Length of Gores, &c. ... ...
14. Lug: Giving Length of Gores, &c. ... ...
15. Jib (Ordinary-Cut): Showing Method of Calculating Number of Cloths required for Foot, &c. 22
16.
17. Drawings on Half-inch Scale: Showing Method of Treating Seam Allowance, &c. 80
18. Cutter's Mainsail (Diagonal-Cut) ... ...
19. Yawl or Ketch's Mainsail (Diagonal-Cut) ... ...
20. Foresail (Diagonal-Cut) 116
21. Jib-Headed Topsail (Diagonal-Cut) ... ...
22. Yard Topsail (Diagonal-Cut) ... ...
23. Jib (Diagonal-Cut) ... ...
24. Mainsail (Horizontal-Cut)... 136
25. Foresail (Horizontal-Cut)... 138

THE
ART AND SCIENCE OF SAILMAKING.

CHAPTER I.

THE MATERIALS USED AND THEIR RELATION TO SAILS.

STRETCHING TENDENCY OF SAIL-CLOTH—SELECTING SAIL-CLOTH—WHAT TO DO IN CASE OF A SLACK SELVAGE—THE BEST SAIL-CLOTH—TABLES OF SAIL-CLOTH—THE BEST BOLT ROPE—ITS FLEXIBILITY—TABLES OF BOLT ROPE.

As it is impossible to learn the English language unless the alphabet is first mastered, so is it necessary to study the manufacture of the materials to be worked up before one can gain a scientific knowledge of flat and lifting sails.

It is a well-known fact that sail-cloth has threads running across it called the *weft*, and others running lengthwise called the *warp*, which latter run over and under the weft, and that when strain is applied to an angle of the cloth, it will stretch.

The threads of the canvas which run directly across upon the square line from selvage will not give out. The difficulty which the sailmaker, therefore, has to encounter is to calculate to what extent the cloths that are cut on the angle (or gores, as they are called) will stretch when affected by the force of the wind, etc., for unless a true calculation and allowance be made, an uneven and pressing sail will result.

It is important that a sailmaker should be certain as to the mean width of the canvas, or it might throw him out in his calculations; also to test the selvages, for should they be uneven, a flat sail will not be produced. When the canvas is found to have a slack selvage, the tight one should be pulled upon until it is even with the other. It is best to put the cloths that have the slackest selvages into the fore part of a sail, working out to the leech with the even ones.*

A fore and aft sail, especially a mainsail, should be made so that all parts bear a proportionate strain, and within the angle of the throat to clew—the mast and foot—should be a perfect plane; and from the centre of effort towards the after leech there should be freedom of exit for the wind. A fore and aft mainsail for a large cutter yacht is considered the most difficult to produce, so that it shall be both flat and lifting; but if the reader carefully studies the method of production, which will be set forth in the following pages, he will be enabled to make this particular sail with as much ease as any other.

If more attention were given to the manufacture of canvas, and to the displacement caused in the threads when in their relative position in sail by strains, and if a correct allowance were made for such displacement, the greater part of the yacht-sailmaking trade of the world would not be confined to a single firm as is now the case.

The following tables of numbers of canvas are suitable for the sails of the vessels mentioned; but should linen, cotton or any other material be used, the sailmaker must exercise his own judgment as to suitable weight. The manufacture of these materials is similar to that of flax canvas, and consequently they have the same stretching tendency. (For the allowances needed, see Chapter VI.).

---

* Messrs. T. C. Hayward and Co., of Crewkerne, and 93, Minories, London, E., manufacture the best and most reliable sail-cloth for fore and aft work, as strict attention is paid to the evenness of the cloth, as well as to the material used.

NUMBERS OF CANVAS suitable for CUTTER YACHTS, YAWLS, and SMACKS.

REGISTER TONNAGE.	Mainsails.		Foresails.		Topsails.					Jibs.				Spinnakers
					Jib Headed.		Working Yard.		Balloon.	1st.	2nd.	3rd.	4th.	
	18in.	12in.	18in.	12in.	18in.	12in.	18in.	12in.	18 in.	18in.	18in.	18in.	18in.	
80 and over	0	1	1	2	2	3	5	6	8	5	4	3	2	Linen or some other light material.
60 to 80	1	2	2	3	3	4	6	7	9	6	5	4	3	
40 ,, 60	2	3	3	4	4	5	7	8	10	7	6	5	4	
30 ,, 40	3	4	4	5	5	6	8	9	11	8	7	6	5	
20 ,, 30	4	5	5	6	6	7	9	10	12	9	8	7	6	
10 ,, 20	5	6	6	7	7	8	10	11	Light Linen or Cotton.	Light Linen or Cotton.				
5 ,, 10	6	7	7	8	8	9	11	12						

(2) For SCHOONERS.

REGISTER TONNAGE.	Mainsails.		Foresails.				Topsails.					Jibs.			
			Boom.		Stay.		Jib Headed.		Yard.		Balloon	1st.	2nd.	3rd.	4th.
	18in.	12in.	18in.	12in.	18in.	12in.	18in.	12in.	18in.	12in.	18 in.	18in.	18in.	18in.	18in.
200 and over	0	1	1	2	1	2	2	3	4	5	7	5	4	3	2
100 to 200	1	2	2	3	2	3	3	4	5	6	8	6	5	4	3
80 ,, 100	2	3	3	4	3	4	4	5	6	7	9	7	6	5	4
60 ,, 80	3	4	4	5	4	5	5	6	7	8	10	8	7	6	5
40 ,, 60	4	5	5	6	5	6	6	7	8	9	11	9	8	7	6
20 ,, 40	5	6	6	7	6	7	7	8	9	10	12	10	9	8	7

(3) For BOOMSAIL BARGES.

BURTHEN. TONNAGE.	Mainsail.	Foresail.	Topsail.	Mizzen.	Jibs.		
					Inner.	Standing.	Flying.
	24 in.	24 in.	24 in.	24 in.	24 in.	24 in.	24 in.
200 and over	00	1	2	2	2	3	5
150 to 200	0	1	3	3	3	4	6
120 ,, 150	1	2	3	3	3	4	6
80 ,, 120	1	2	3	3	3	4	7

(4) For SPRIT BARGES.

BURTHEN. TONNAGE.	Mainsail.	Foresail.	Topsail.	Mizzen.	Jibs.	
					1st.	2nd.
	24 in.	24 in.	24 in.	24 in.	24 in.	24 in.
80 and over	1	2	3	4	5	3
60 to 80	2	3	4	5	6	4

Bolt-rope for sails should be of the very best manufacture.* Not only is the best make required, but also a knowledge of its flexibility, which must be considered when taking in the slack canvas.

By practical experience it is found necessary, for the proper roping of sails, that one have a knowledge of the relative strains which bear upon various parts of sails, in order to adjust the size of the rope to the strain to be applied, basing the calculation upon the greater as well as the less strain affecting a rope at any given point. Take, for instance, the clew rope of a mainsail; there is more strain directly nearest to the clew than above it; the size, therefore, should be calculated upon the greater strain.

The tables which are here given (pp. 6 to 8) allow for the stretching of the ropes that receive direct strain—such as the mast and head ropes of mainsails, stay ropes of jibs, foresails, etc.—at the rate of the size in circumference per yard of the length.

Clew ropes of sails and head ropes of sprit barges' mainsails need to be much larger, as they have to stand severe jerks.

In Chapter IX., upon Roping, will be found calculations of various ropes which should be sewn on according to the strain to be applied, as it displaces the threads of the canvas upon certain lines, and causes such parts to stretch, requiring, accordingly, an allowance to be made. The rope should be sewn on slack, to allow for the giving out of the gores upon certain parts of sails, or *vice versâ,* by sewing slack cloth in the rope, as the case may be.

---

* Such as that made by Messrs. G. Langford and Son, of Portsmouth, or Messrs. H. Bannister and Co., of Cowes, Isle of Wight—firms who have made the manufacture of bolt-rope a speciality.

SIZES IN CIRCUMFERENCE for BOLT ROPE suitable for SAILS for YAWLS.

REGISTER TONNAGE.	Mainsail.			Foresail.		Topsails.					Jibs.							
						Jib Headed.		Yard.			1st.		2nd.		3rd.		4th.	
	Mast.	Head.	Clew.	Stay.	Clew.	Mast.	Clew.	Mast.	Head.	Clew.	Stay.	Clew.	Stay.	Clew.	Stay.	Clew.	Stay.	Clew.
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
150 and over ...	5	2	6	3	3½	3	2¾	3	1¾	2⅞	5	3½	5	3½	5	3½	6	4
100 to 150	4¾	2	5¾	2⅞	3¼	2⅞	2⅝	2⅞	1⅝	2¾	4¾	3¼	4¾	3¼	4¾	3¼	5¾	4
80 ,, 100	4½	1⅞	5½	2¾	3	2¾	2½	2¾	1½	2⅝	4½	3⅛	4½	3⅛	4½	3⅛	5½	3¾
60 ,, 80	4¼	1¾	5	2⅝	2⅞	2⅝	2⅜	2⅝	1⅜	2½	4¼	3	4¼	3	4¼	3	5	3½
40 ,, 60	3¾	1⅝	4¾	2½	2¾	2½	2¼	2½	1¼	2⅜	4	2¾	4	2¾	4	2¾	4½	3
30 ,, 40	3¼	1⅝	4	2¼	2½	2⅜	2⅛	2⅜	1⅛	2¼	3½	2½	3½	2½	3½	2½	4	2¾
20 ,, 30	2¾	1½	3½	2⅛	2¼	2¼	2	2¼	1	2⅛	3	2¼	3	2¼	3	2¼	3½	2½

(2) For SCHOONERS, with Sliding Bowsprit.

REGISTER TONNAGE.	Mainsail.			B. Foresail.			S. Foresail		Topsails.					Jibs.							
									Jib Headed		Yard.			1st.		2nd.		3rd.		4th.	
	Mast	Head	Clew	Mast	Head	Clew	Stay	Clew	Mast	Clew	Mast	Head	Clew	Stay	Clew	Stay	Clew	Stay	Clew	Stay	Clew
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
200 and over	4½	2	5½	4	1⅞	5	3	3½	3	2⅞	3	1¾	2⅞	5½	3½	5½	3½	5½	3½	6	3¾
150 to 200	4¼	2	5¼	3¾	1¾	4¾	2⅞	3⅝	2⅞	2¾	2⅞	1⅝	2¾	5¼	3½	5¼	3½	5¼	3½	5¾	3¾
120 ,, 150	4⅛	2	5	3⅝	1¾	4½	2¾	3½	2¾	2⅝	2¾	1½	2⅝	5	3⅜	5	3⅜	5	3⅜	5⅝	3⅝
100 ,, 120	4	2	4¾	3½	1¾	4¼	2¾	3⅜	2⅝	2½	2⅝	1⅜	2½	4¾	3¼	4¾	3¼	4¾	3¼	5	3½
80 ,, 100	3¾	1⅞	4½	3¼	1⅝	4	2⅝	3¼	2½	2⅜	2½	1¼	2⅜	4½	3	4½	3	4½	3	4¾	3¼
60 ,, 80	3½	1¾	4	3	1½	3¾	2½	3	2⅜	2¼	2⅜	1⅛	2¼	4	3	4	3	4	3	4¼	3¼
40 ,, 60	3¼	1½	3½	2¾	1½	3¼	2¼	2¾	2¼	2⅛	2¼	1	2⅛	3½	2¾	3½	2¾	3½	2¾	4	3⅛
30 ,, 40	3	1½	3¼	2½	1¼	2¾	2⅛	2½	2⅛	2	2⅛	⅞	2	3	2½	3	2½	3	2½	3¼	3

(3) For KETCH BARGES.

BURTHEN. TONNAGE.	Mansail.					Foresail.				Topsail.		Missen.					Jibs.							
																	Inner.				Standing.			
	Mast	Head	Lch.	Clew	Foot	Stay	Lch.	Clew	Foot	Mast	Clew	Mast	Head	Lch.	Clew	Foot	Stay	Lch.	Clew	Foot	Stay	Lch.	Clew	Foot
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
200 and over	3¼	2	3¼	5½	2⅛	2¾	2¼	4	2	2¾	2¾	2¾	1¾	2	3⅞	1¾	2¾	2	2¾	2	2¾	2	2¾	2
150 to 200	3	1¾	3	5	2	2⅝	2⅛	3½	1⅞	2¾	2¾	2⅝	1½	1⅞	3½	1⅝	2½	1⅞	2½	1⅞	2½	1⅞	2½	1⅞
120 ,, 150	2¾	1⅝	2¾	4½	1⅞	2½	2	3	1¾	2⅝	2⅝	2½	1⅜	1¾	3¼	1½	2⅜	1¾	2⅜	1¾	2⅜	1¾	2⅜	1¾
100 ,, 120	2¾	1⅝	2½	4¼	1¾	2½	1⅞	3	1⅝	2⅝	2⅝	2½	1⅜	1⅝	3	1⅜	2⅜	1⅝	2⅜	1⅝	2⅜	1⅝	2⅜	1⅝

(4) For SPRIT BARGES.

BURTHEN. TONNAGE.	Mainsail.				Foresail.				Topsail.				Mizzen.				Jibs.					
																	1st.			2nd.		
	Mast	Head	Lch.	Foot	Stay	Lch.	Clew	Foot	Mast	Lch.	Clew	Foot	Mast	Head	Lch.	Foot	Stay	Clew	Foot	Stay	Clew	Foot
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
100 and over ...	3½	8	4¼	2	2¾	2	3½	2	2¾	1⅞	2⅞	1¾	2¼	2¼	2¼	1⅝	3¼	3	1¾	3½	3¼	1⅞
80 to 100	3¼	7½	4	1⅞	2⅝	1⅞	3¼	1⅞	2¾	1⅞	2¾	1⅝	2⅛	2⅛	2⅛	1½	3⅛	2⅞	1⅝	3¼	3	1¾
60 ,, 80	3	7	3¾	1¾	2½	1¾	3	1¾	2½	1¾	2½	1½	2	2	2	1⅜	3	2¾	1½	3⅛	2¾	1⅝
40 ,, 60	2¾	6	3¼	1⅝	2¼	1½	2½	1⅝	2	1½	2	1⅜	1¾	1¾	1¾	1¼	2¾	2½	1⅜	2⅞	2½	1½

CHAPTER II.

ON THE CENTRE OF EFFORT.

Importance of Finding Position of Centre of Gravity—To Find the Centre of Effort—Treatment of Slack Seams—Drawings.

It is very important that the point or place in a sail where the whole effort of the wind is supposed to be collected—commonly called the centre of effort—should be determined, for correct allowances cannot be made unless its true position is found.

It is only by the wind's motion as it strikes the centre of a sail, and makes its exit out of the leech, that a vessel is propelled through the water when close hauled. Wind that is retarded in its course by uneven sails hinders the progress of a vessel, as it is so much force misapplied, and has a tendency to press the vessel down into the trough of the sea. The majority of sailmakers—some of whom are occasionally entrusted with orders for yachts' sails—never consider this all-important question, but merely work upon a rule-of-thumb knowledge, the result of which is that they cannot guarantee sails of any size and shape, however near to perfection they may at times be made, as almost every sail differs in the angle from that of another, and consequently there is a difference in the centre of gravity. This statement is made from a knowledge acquired of the sailmaking world, including the testimonies of many yachtsmen, some of whom have sailed in the fastest racing yachts of the day.

A practised eye can detect several centres of gravity in many fore and aft sails when trimmed close to the wind. Some have only one, but it bulges out, proving that sufficient allowances were not made to withstand the force of the wind at that point.

Tracings of fore and aft sails are given in this chapter (Figs. 1 and 2), showing in each the centres of effort and a method of finding the same.

In the first place a geometrical plan of the sail must be drawn.

The centre of effort of jibs, foresails, jib-headed topsails, and all such triangular sails, is found by striking a line from the head (*a*) to the centre of foot line (*b*), and marking another line from the clew (*d*) to the centre of stay line (*c*): where the lines intersect each other, marked by a star, is the centre of effort of the sails (see Fig. 1).

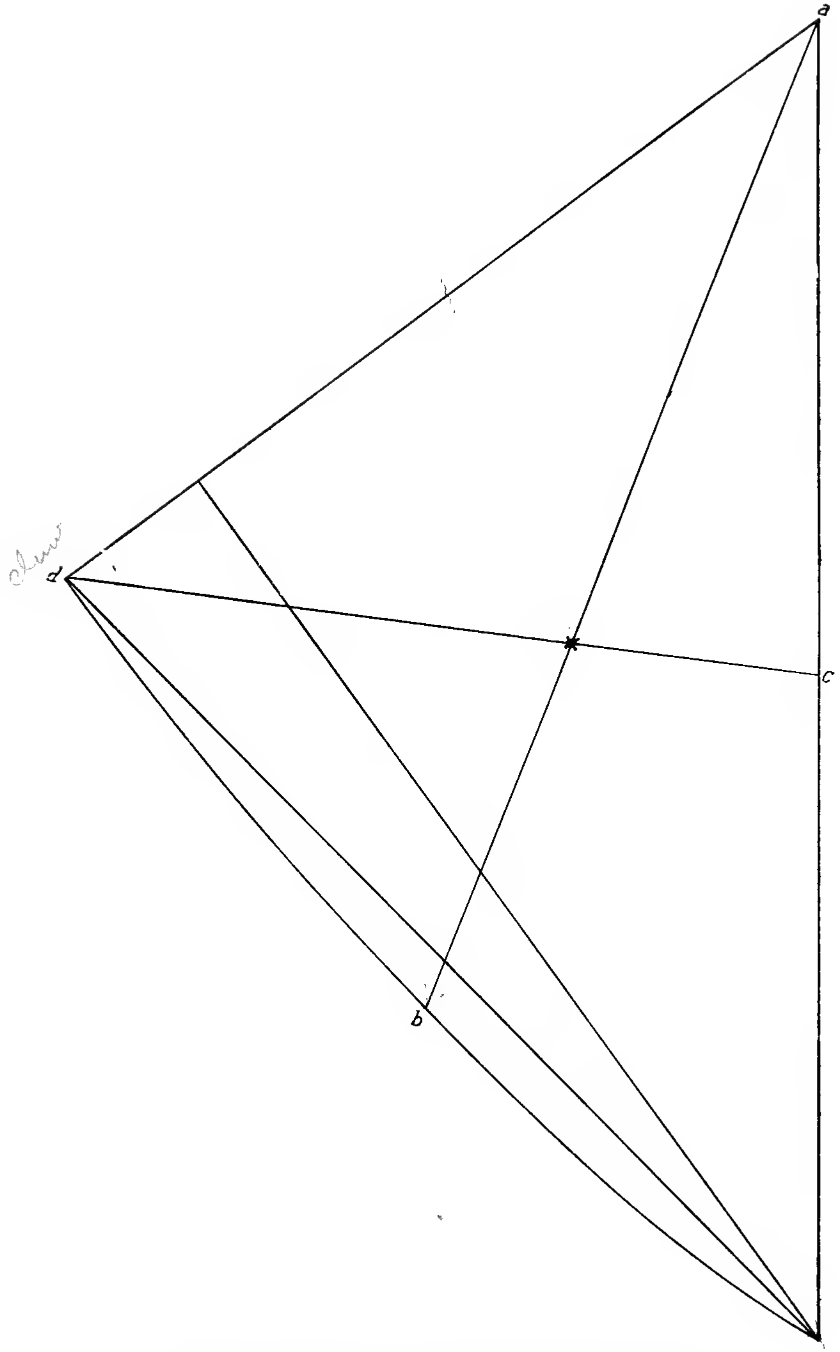
To find the centre of a mainsail, or any similar-shaped sail, a diagonal line is drawn from the throat to clew (*a* to *b*) forming two triangles; the centre of each is then found in the same way as already described for triangular sails. A line should then be struck from the two centres, the centre of which line—shown by a star—is the centre of effort (see Fig. 2).

The lines that are drawn from the centre of gravity towards the head and leech of the sail show the position in which the slack of the seams requires to be taken in, to give a freedom of exit for the wind out of the after leech, without affecting those lines that receive direct strain, such as the diagonal line from the throat to clew, and the square line from the tack to leech, within which lines should be a perfect plane and tight as the head of a drum.

The method given of treating the slack of seams may differ from that followed by many in the trade, and the propriety of such difference may be questioned; but by practical experience it will be found to be true and reliable. Many persons who are considered scientific sailmakers are a long way out in their treatment of slack seams. From the position of the slack shown in Fig. 2, there will be greater effect produced if a less quantity of slack than is usual in the trade

Fig. 1. JIB-HEADED TOPSAIL.

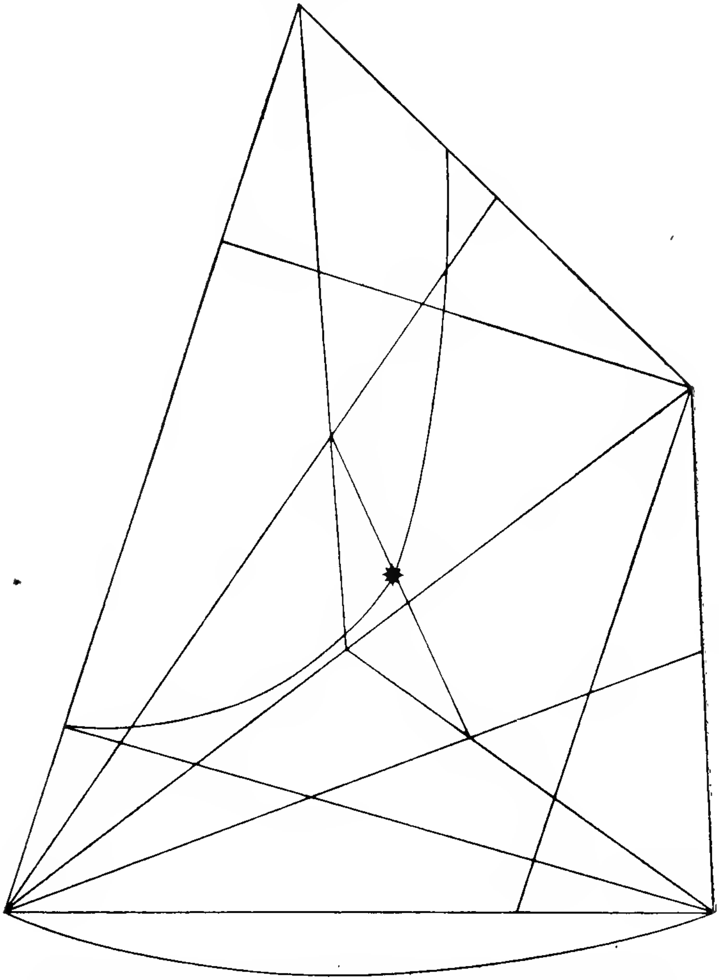
(Scale, $\frac{1}{8}$ in. per foot.)



Triangular Sail, showing method of finding centre of effort.

Fig. 2.—FORE AND AFT MAINSAIL.

(Scale $\frac{1}{16}$ in. per foot.)



Showing method of finding centre of effort, and giving lines indicating position of slack seams.

be taken in. What proportion of slack is required depends materially upon the angle of the sail, and whether the sail is laced or has a round foot. The calculation for No. 1 mainsail is at the rate of 3 in. of slack seam per 1 ft. of the clew gore. The gore is 16 ft., and the amount of slack taken in upon the seams is therefore 4 ft.

The sails which require to be treated upon the centre of effort are such as need to be hollow to the mast or stay, as the case may be. For instance, such sails as are cut down from the tack—as mainsails, foresails, topsails, etc.—in consequence of the gores stretching outward towards the clew. These sails also require slack in the seams. Such sails as jibs and yard topsails, where the gore is cut up from the tack, need to be treated differently, as the gores stretch inward towards the tack; the allowance, therefore, should be dealt with in the reverse way to those sails which are cut down from the tack. (See treatment of jib, Fig. 8).

The position of the centre of effort of the sails upon a yacht or other vessel, as to their lifting or pressing tendency, is in the province of the designer, and has considerably to do with the speed of the vessel. Even when correctly calculated, if the sails are not manufactured so as to have a good effect, their good points will to a great extent be neutralised and the sails will reflect discredit upon the designer.

CHAPTER III.

ON MEASURING.

Vessels to be Measured when Afloat—Importance of knowing exact Stand of Masts—Spars to be Measured to their full Extent—To get Dimensions for Sails—Sheets determined when set off upon Paper—To get Dimensions for Single Sails.

When measuring a vessel for a suit of sails, it is necessary that it be done when she is afloat, as the sheer of the vessel can then be got by measuring from her deck to the water-line, which should be taken at the bows, amidships, and aft.

It is very important that the exact stand of the masts be known, as a slight difference one way or the other from the perpendicular will throw the whole of the sails out of proper angle, unless rightly treated. This can be easily ascertained when a vessel is afloat and in proper trim.

All spars are measured to their full extent, so that a vessel when set off upon paper is seen from the water-line to the height of the topmast, and with extremes of spars and stays.

Having got the sheer of the vessel measured, the full extent of the masts, and determined the stand of same, it is necessary to take the distance of the main, fore, and jib halyard bolts, either from the masthead or deck. The housing of the topmast should next be measured, and the length of the head of same; also the distance from the topmast head to sheave for the halyards. Then measure the distance from out-hauler to the end of boom and from the sheave to end of gaff.

It is very important—although deemed by the majority of sailmakers only a trifling matter—to notice that the length of the bolt upon gaff, to which the throat of sail is attached, be measured, and its distance from mast when gaff is in position.

When setting a vessel off allowances can be made—such as the distance from gaff to main-halyard bolt and height of the boom from deck, also position of the sheets of headsails.

To get dimensions for the foresail, measure the length of bow from the mast to stem, height of the stem from deck, distance of the stay above the fore-halyard bolt, and what distance, if any, from the stay upon stem to where the tack will be fixed.

For the jib measure the length of bowsprit outside stem, and width of the bows, which is very necessary in the case of a broad bowed vessel.

For the fine weather topsail, the length of the yard only is measured, as the other dimensions—such as the leech and foot—must be governed by the head of the mainsail when set off.

All sheets are determined when set off upon paper. When only measuring for a mainsail, trouble need not be taken to get the sheer of the vessel and stand of mast. To find the angle of the sail, take a diagonal line from the throat to clew when the boom is in position.

For a foresail, take the length of stay from the bolt in mast down to the stem; get leech from the bolt to deck, and the foot from the mast to stem; measure the distance from the bolt to upper part of stay, the difference, if any, from stem where stay is fixed to the point where tack of sail will be fast, and the distance from the deck to upper part of stem.

For a jib, take the length from jib-halyard bolt to outer part of bowsprit; get leech from the bolt to top of stem, from the end of bowsprit to stem, and from the stem to mast.

For a topsail, take the length of topmast from the sheave hole to throat of mainsail when set, length of the gaff and yard, and the angle from topmast sheave hole to outer end of gaff.

For a sprit mainsail, take the length of hoist to mast, the length of sprit, and distance from mast to main horse. These dimensions are sufficient, as the length of the head and leech are determined when set off.

Nothing further need be said as to how to get dimensions, as most sailmakers are fully aware of the method. Proper allowances are the most important.

CHAPTER IV.

ON DRAWING.

DRAWINGS SHOULD BE BASED UPON A SQUARE—CARE TO BE EXERCISED IN SQUARING OFF SAILS—GEOMETRICAL DRAWINGS OF CUTTER YACHT'S MAINSAIL (ROUNT FOOT), CUTTER YACHT'S MAINSAIL (LACED FOOT), YAWL YACHT'S MAINSAIL, BARGE'S SPRIT MAINSAIL, YACHT'S STAY FORESAIL, JIB (ORDINARY CUT), JIB (DIAGONAL CUT), YARD TOPSAIL, JIB-HEADED TOPSAIL, BARGE'S TOPSAIL, BALANCE LUG AND LUG SAIL.

IN reference to drawing, the author does not profess to deal with the subject in any scientific manner, but only for the purpose of illustration in giving the form and measurement, and for correctly showing the dimensions of the leeches, stays, and total amount of the gores on the head and foot, etc., of sails.

A few geometrical drawings (Figs. 3 to 14) are given, sufficient to prove the force and value of the calculations, showing the principle on which they are founded, and that they will apply to such sails, whether large or small, much or little gore.

It is essential that a drawing be based upon a square. For instance, when setting off a vessel, a line should be drawn across in the position of her water-line, from which her masts should be located in desired position, and sails set off in full by direct lines. The necessary round of foot should also be shown.

Care must be taken in squaring off sails, especially from the after leeches to throat and tack, which gives the gore of the mainsail.

In Fig. 3 (*Racing Cutter Yacht's Mainsail*), the lines from *a* to *b*, *b* to *c*, *c* to *d*, and *d* to *a*, indicate the square of the sail; from *a* to *e*, the peek gore; from *b* to *f*, the clew gore; from *c* to *g* the mast gore; from *d* to *f*, the angle; from *f* to *g*, the line of boom, and that below, the round of foot. The line leading from *a* to the head indicates the amount of stretch upon the head, and the line from *b* to the foot the amount of the stretching of the foot. The line leading from the mast to leech through the centre is squared from the mast, and consequently is the line of pressure.

In Figs. 4, 5 and 6, the lines upon these sails are similar to those already described as regards position and indication.

In Fig. 7 (*Stay Foresail*), the line leading from the tack (*c*) to *b* upon the leech is the square line from the leech. That from the tack to clew is the direct line by which the seams should be creased to and from for the stretching, and also for the round of foot. The line from *g* to *f* is the strain of clew, outside of which there should be no wide seam creased for the foot. The line upon the foot from *e* to *f* shows the amount of round.

Fig. 8. (*Ordinary Cut Jib*).—The straight lines extending from *c* to *a*, *a* to *d*, and from thence to *c*, give the size of the sail when fully stretched. The line across the sail from *a* to *b* is the square line from leech. The line from *b* down to the foot (*e*) indicates the amount the foot will stretch from that point to tack. The upper part of the same line shows an addition to the square line, and is carried out beyond straight line of stay for the needed flow. The line from *b* to *f* upon the leech gives the amount the upper part will stretch, and the inner line from *f* to *e* is the straight line from the head to tack when rubbed in. The amount of flow required when spread is as much as the distance from the inner line to the outer, marked *b*.

Fig. 9. (*Diagonal Jib*).—The half-circle shown at the sheet is made in order that the true position of the last may be found. The line leading from the sheet through the centre of the half-circle to the stay is the position of the last. The line *a* upon the leech to the stay is the square line from leech, which shows the amount of gore required. The line from *e* upon foot to the stay is the corresponding line to that upon the upper part, and gives the amount of gore.

The outer line leading from the sheet towards the tack is the line from which the number of cloths needed in the stay of the lower part is derived. This is obtained by ascertaining the length of the square line of the upper part, from *a* upon the leech to the stay line, and measuring the corresponding line upon the lower part, and if found shorter than upper line, extend to the same length. Then square from that line towards the tack, and if the line is short, as in this case, the stay will need one cloth less than that of the last. If the lower line is longer than the upper one, by squaring from the point of the corresponding length of the upper line it will determine whether the tack requires more cloth than at the sheet.

The stay lines are similar to those on the jib previously described.

Fig. 10. (*Yard Topsail*).—This sail is shown as set upon topmast. The lines across the sail from the sheet (*b*) to *d* upon the mast and from *a* upon the leech to *c* upon mast are the square lines from leech. The line from the throat (*c*) down to the foot (*g*) is the square line of the throat. The star indicates the position of the centre of effort. The line passing through the centre from the head (*h*) to the sheet is the square line from the mast, and therefore the shortest distance from the centre to any given point upon the edge of the sail. As it is a fixture it is the line of pressure.

The upper line across the sail is a square line from the leech to meet the point of pressure at the head (*h*), and is the line upon which the head seams should be commenced for the stretching of the head.

The line inside the leech from *i* to *j* shows the amount which the head will stretch (*j* to *e*). The line from *d* upon the mast to *k* at the foot shows the amount of the giving out at foot (*k* to *f*). The straight line from the tack to sheet is the line upon which the wide seam should be calculated for the stretching of the foot, and also where the wide seam should be commenced for the round of foot.

Fig. 11. (*Jib-Headed Topsail*).—The line from the leech (*c*) across the sail to the tack (*d*) is the square line from the leech, and the length from that line to the clew is the amount of the foot gore, and from the same line to the head (*a*) shows the amount needed for the mast gore. The star indicates the centre of effort, and the line from mast to the star is a square line from the mast. It is the shortest line, and therefore the line of pressure.

The direct line from the clew (*b*) to the star is the line of pressure at the clew. The line from *b* to the tack (*d*) is the line on which the first calculation of the seams is made for the giving out of the foot, and is the line from which the seams for the round of foot should be started.

Fig. 12. (*Barge's Topsail*).—The topmast is shown so that the position of the topsail may be seen on the topmast. Sufficient has already been said, in respect to the lines upon the other sails, to make the lines on this sail readily understood.

Fig. 13. (*Balance Lug Sail*).—The mast to which the sail is attached is given to show the position of the sail thereon. The lines across the sail from *a* upon the leech to *b* upon the mast, and from *c* upon the leech to *d* at the tack, give the square from the leech to throat and tack. The length of the head gore from *a* to the peak (*g*), and the foot gore from *c* to the clew (*f*), are also given.

The line from the throat (*b*) to the foot (*c*) shows the mast gore, which is from *e* to the tack (*d*). The line starting at *j* upon the leech to foot (*i*) shows the amount of stretch upon the foot (*i* to *j*).

The line from *a* upon the leech to *h* upon the head gives the amount of the stretching of the head (*h* to *g*).

The star shows the centre of effort, and the line passing through from the mast to leech is the line of pressure.

The line from the sheet leading to the point where the line of pressure crosses the square line is the line of strain from the sheet, and outside of which there should be no wide seam creased.

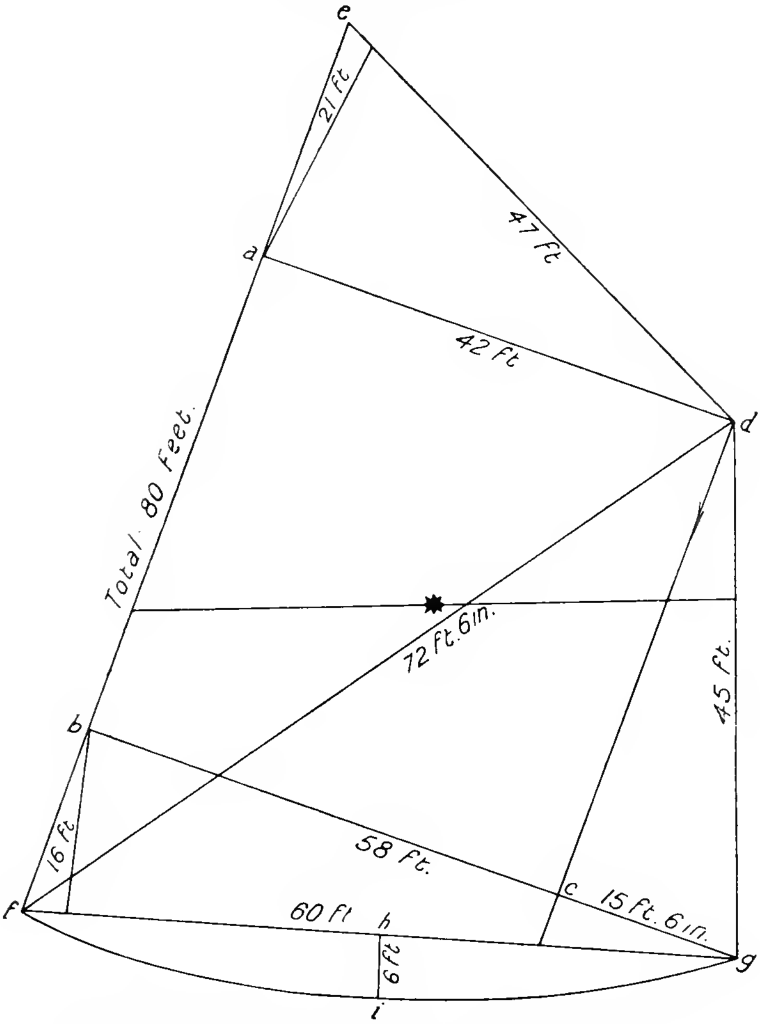
Fig. 14. (*Lug Sail*).—There is no difference in the lines upon this sail from those of the lug previously described, with the exception that the line of pressure is upon the head. The point marked *o* is the position of the line of strain, and the line from thence to *k* upon the leech is the line upon which the head seams should commence to widen for the stretching of the head.

The sail has a round foot; therefore the direct line from the clew to tack is the line on which the first calculation of the seams is made for the giving out of the foot, and is the line which the seams for the round of foot should start upon.

The sail may be made to lace at the foot, if desired, in which case the stretching tendency would only be 2 in. per foot of the clew gore, instead of 3 in., as reckoned for this sail.

Fig. 3.—CUTTER YACHT'S MAINSAIL.

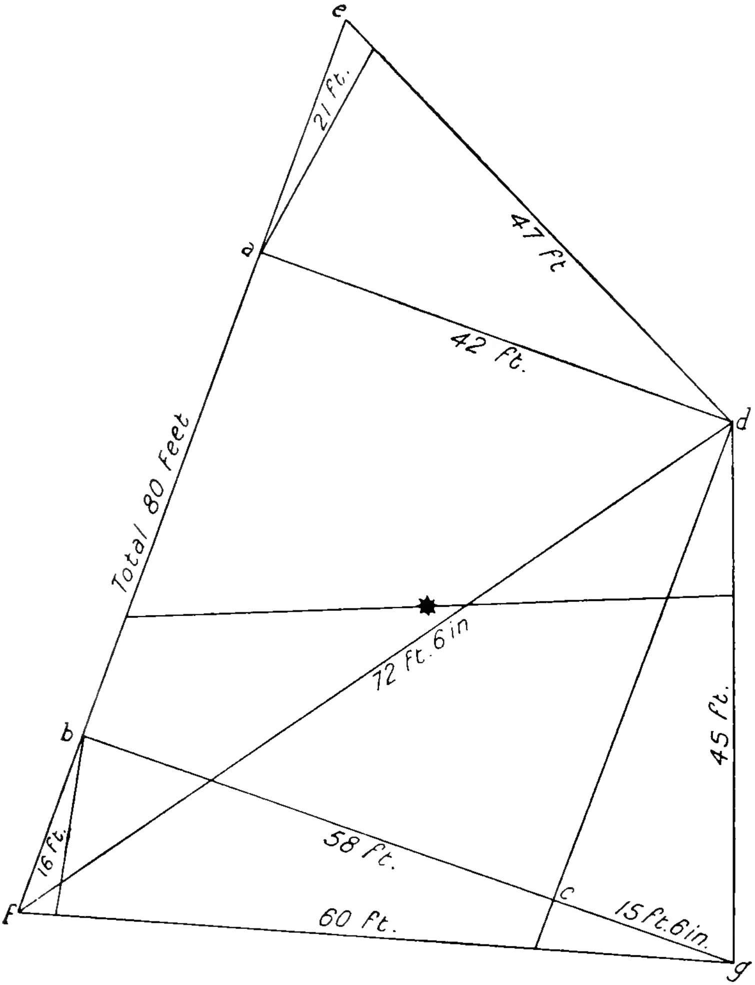
(Scale, $\frac{1}{16}$ in. per foot.)



Giving length of gores, also amount of the stretching of head and foot. For treatment of sail, study the work throughout.

Fig. 4.—CUTTER YACHT'S MAINSAIL (laced foot).

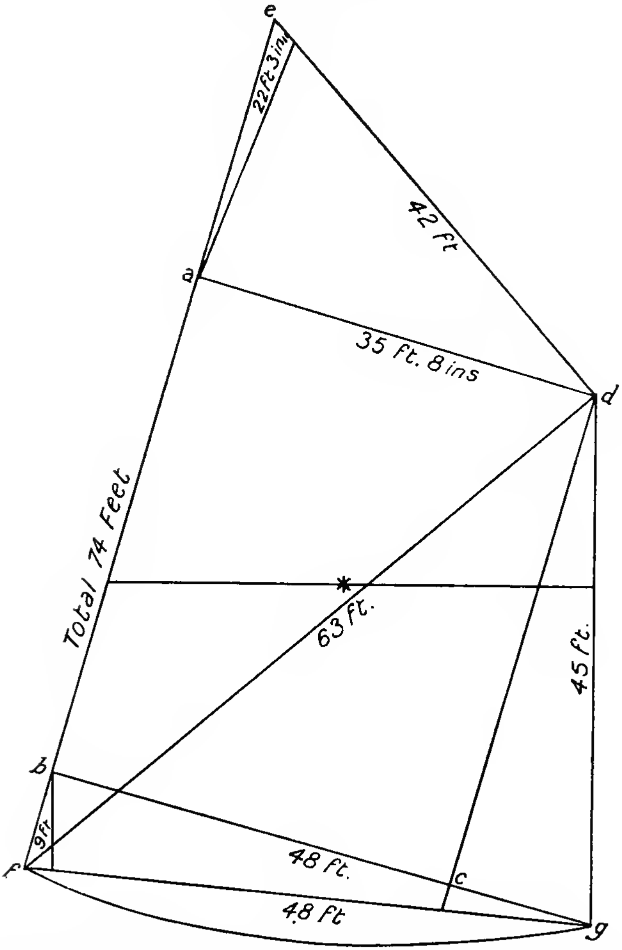
(Scale, $\frac{1}{16}$ in. per foot.)



Giving length of gores, also amount of the stretching of head and foot.
For treatment of sail, study the work throughout.

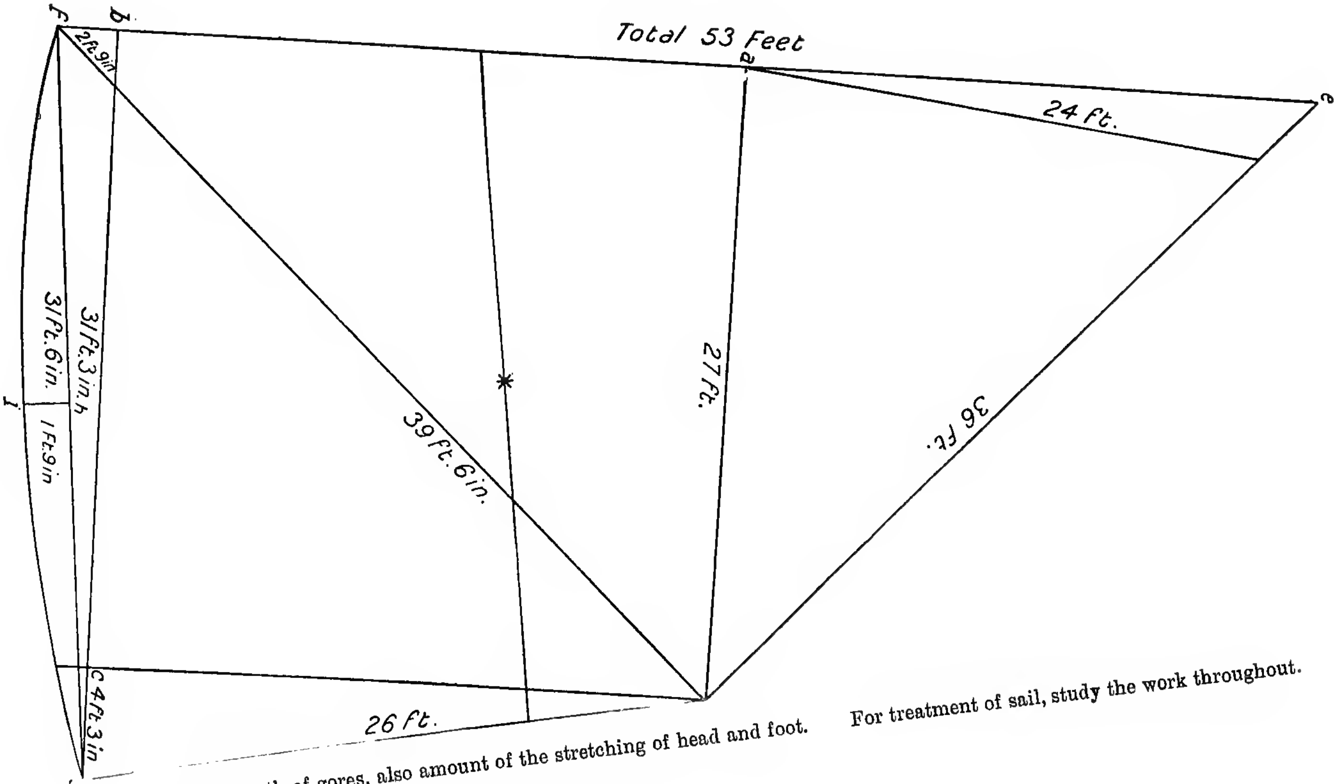
Fig. 5.—YAWL YACHT'S MAINSAIL.

(Scale, $\frac{1}{16}$ in. per foot.)



Giving length of gores, also amount of the stretching of head and foot. For treatment of sail, study the work throughout.

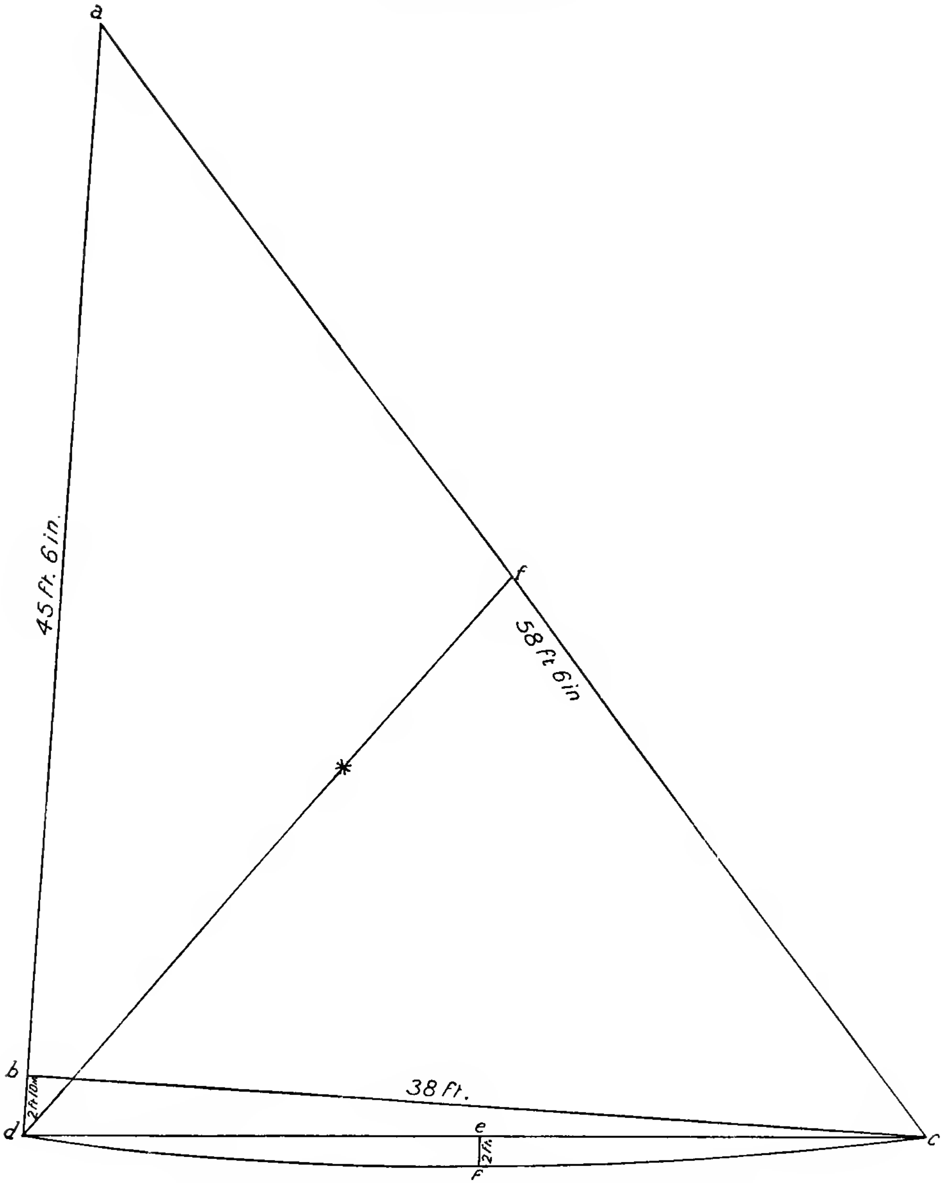
Fig .6.—BARGE'S SPRIT MAINSAIL.
(Scale, ⅛ in. per foot.)



Giving length of gores, also amount of the stretching of head and foot. For treatment of sail, study the work throughout.

Fig. 7.—YACHT'S STAY FORESAIL.

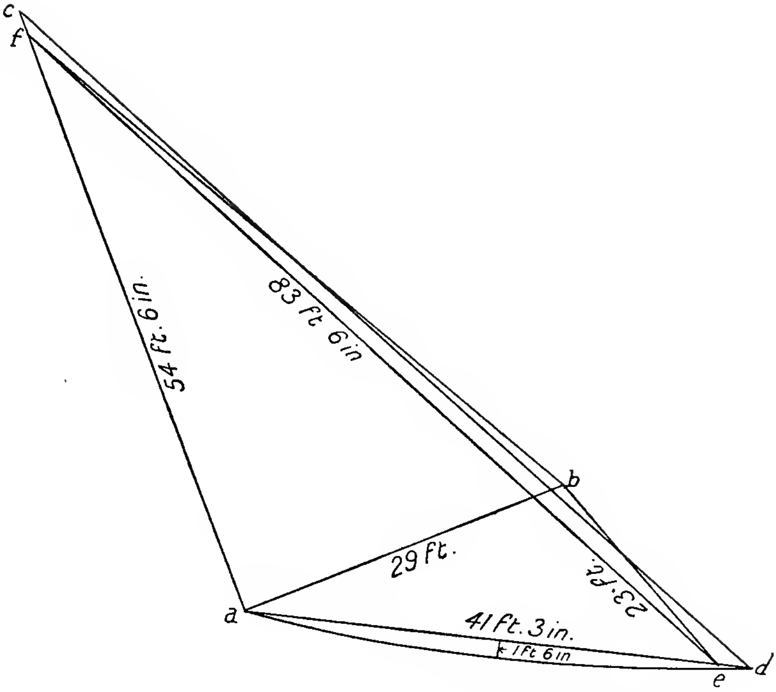
(Scale, $\frac{1}{8}$ in. per foot.)



Giving length of gores, and showing position of strain at clew.
For treatment of sail, study the work throughout.

Fig. 8.—JIB (ordinary cut).

(Scale, $\frac{1}{16}$ in. per foot.)

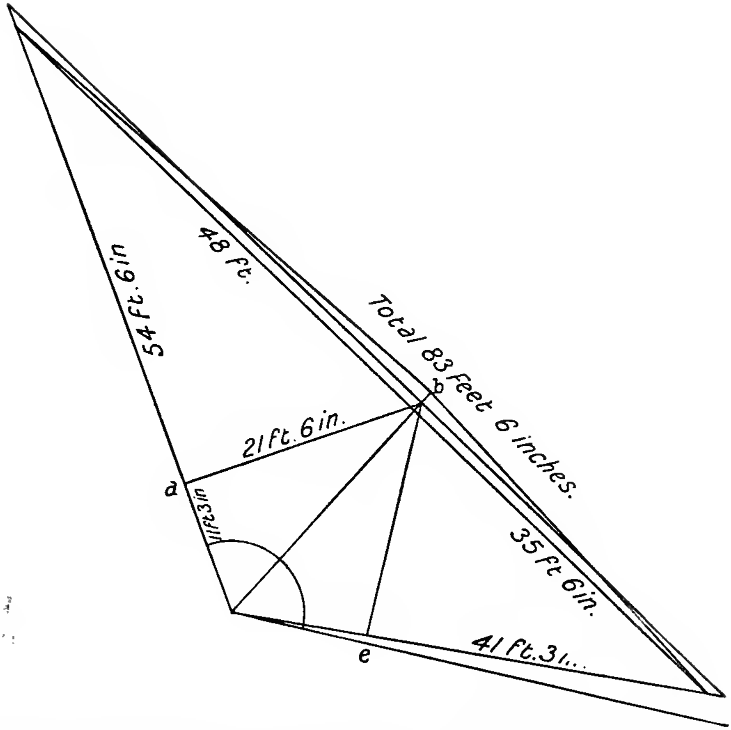


Giving length of foot gore and allowances necessary for sail.

For treatment, study the work throughout.

Fig. 9.—JIB (diagonal cut).

(Scale, $\frac{1}{16}$ in. per foot.)

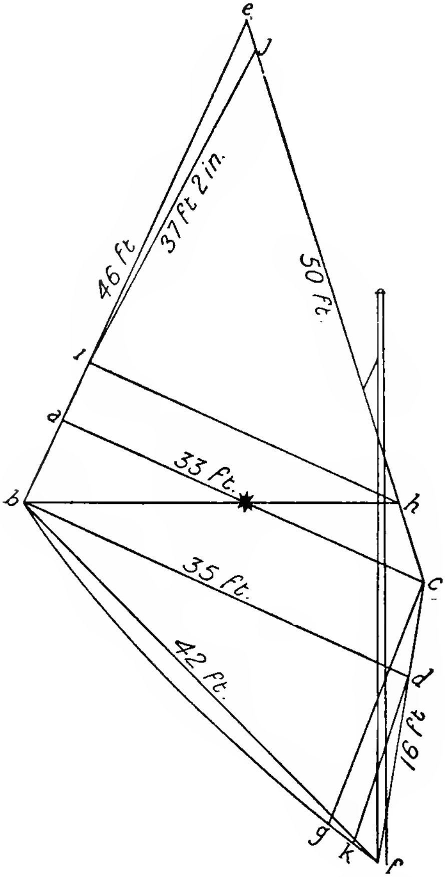


Showing method of finding the amount of last gore required, also number of cloths at stay in relation to last. Allowances necessary for sail are also given.

For treatment, study the work throughout.

Fig. 10.—YACHT'S YARD TOPSAIL.

(Scale, $\frac{1}{16}$ in. per foot.)

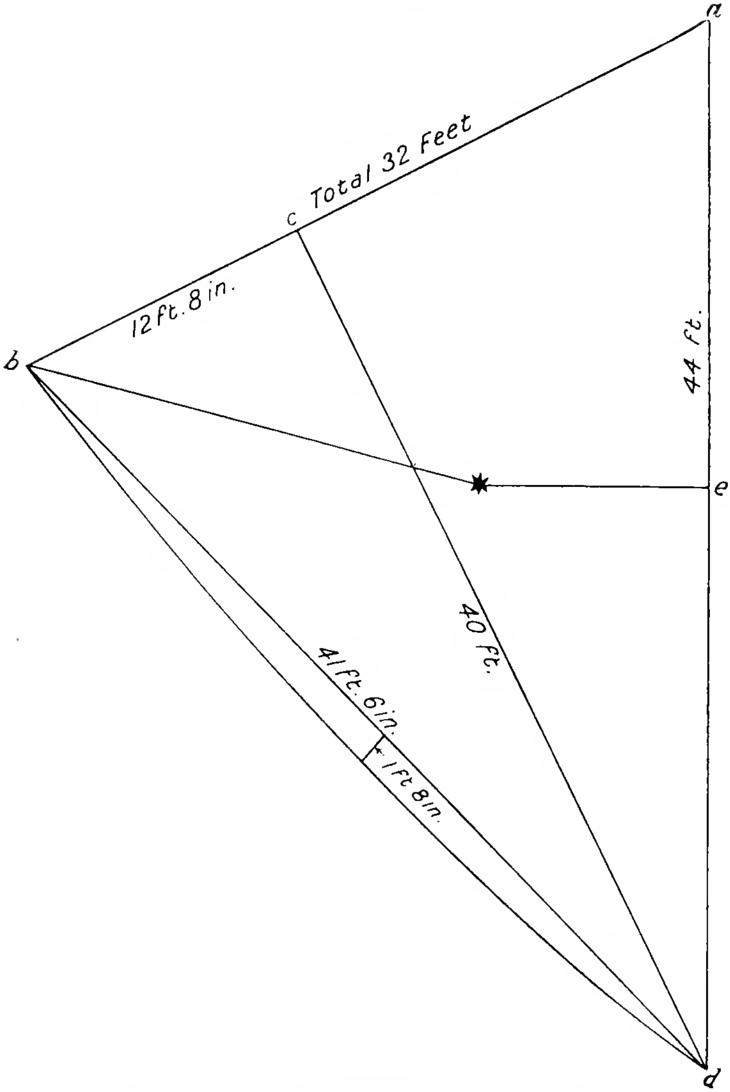


Giving length of gores, also amount of the stretching of head and foot.

For treatment of sail, study the work throughout.

Fig 11.—YACHT'S JIB-HEADED TOPSAIL.

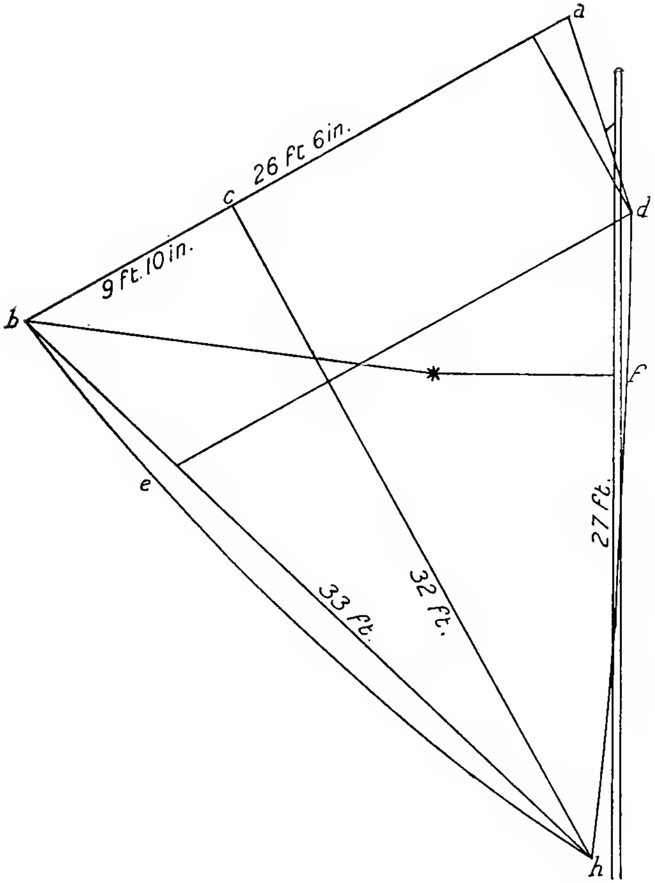
(Scale, $\frac{1}{8}$ in. per foot.)



Giving length of gores and showing position of strain at clew.
For treatment of sail, study the work throughout.

Fig. 12.—BARGE'S TOPSAIL.

(Scale, $\frac{1}{8}$ in. per foot.

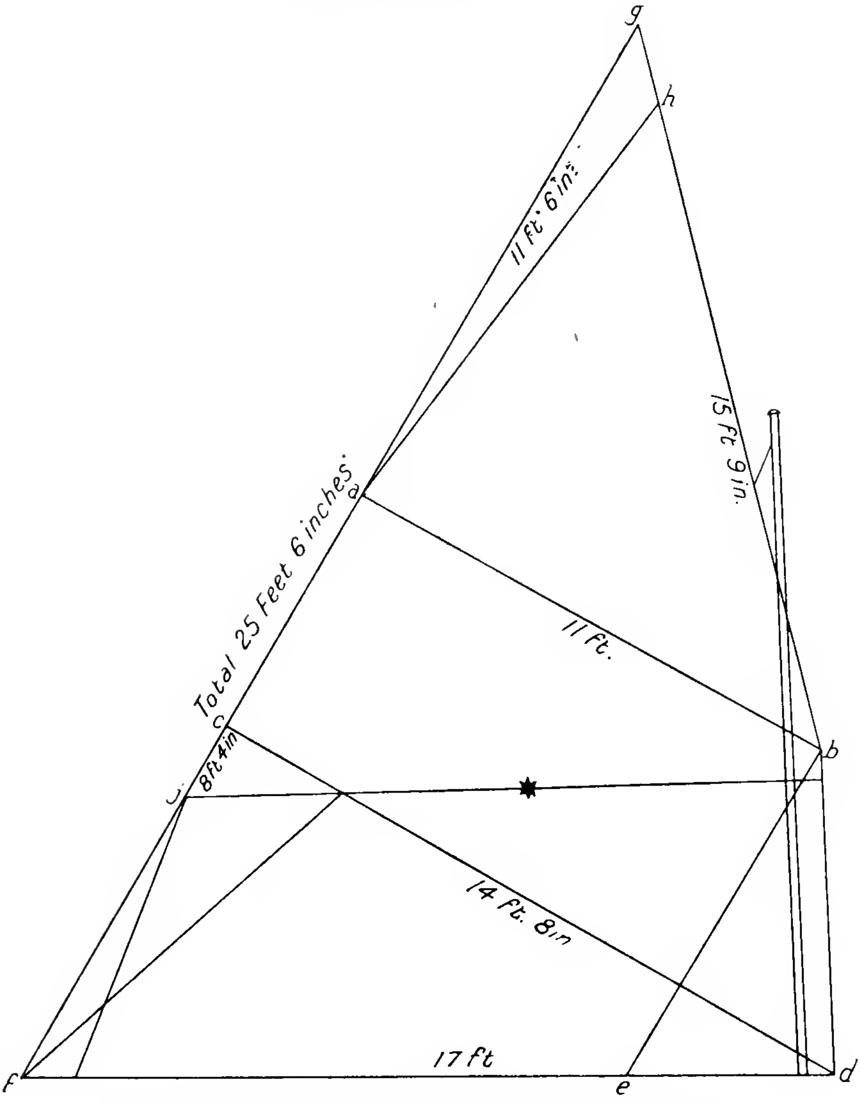


Giving length of gores and showing position of strain at clew.

For treatment of sail, study the work throughout.

Fig. 13.—BALANCE LUG.

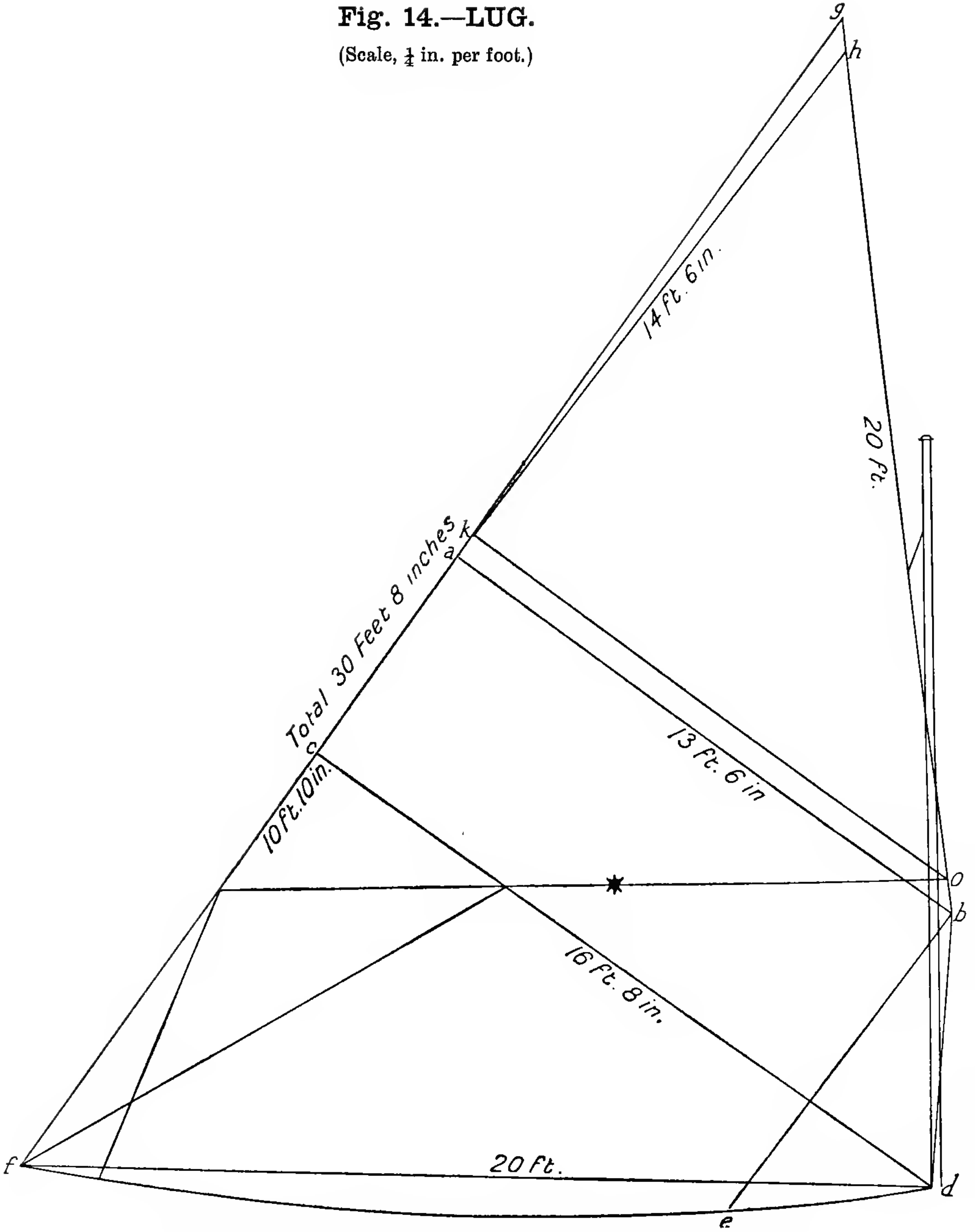
(Scale, ¼ in. per foot.)



Giving length of gores, also amount of the stretching of head and foot.
For treatment of sail, study the work throughout.

Fig. 14.—LUG.

(Scale, ¼ in. per foot.)



Giving length of gores, also amount of the stretching of head and foot.
For treatment of sail, study the work throughout.

CHAPTER V.

ON THE NUMBER OF CLOTHS REQUIRED.

CALCULATION SHOWING THE NUMBER OF CLOTHS REQUIRED FOR HEAD AND FOOT OF CUTTER YACHT'S MAINSAIL—TO FIND NUMBER OF CLOTHS FOR A TRIANGULAR SAIL—DRAWING OF JIB SHOWING METHOD OF GETTING THE SAME.

AN easy method of calculating the number of cloths required for the cutter yacht's mainsails (Figs. 3 and 4), if made of 12-in. canvas, is here given. For the head add together—

	ft	in.	
Length of Square Line (*a* to *d*)	42	0	
41 Seams 1⅛ in. wide	3	10⅛	
5 Seams additional	0	5⅝	
4 in. for Leech Tabling	0	4	
	46	7¾	= 46⅔ cloths.

For the foot add—

	ft	in.	
Mast Gore (*c* to *g*)	15	6	
16 Seams 1⅛ in. wide	1	6	
1 Seam additional	0	1⅛	
	63	8⅞	= 63¾ cloths

The above is the only true method of calculation for this kind of sail. If mast lining is cut with the sail, it must be added to the figures already given.

Should the sail be of 18-in. canvas, the seams should be 1¼ in. wide, as the heavier the canvas used, the wider the seams required.

To find the number of cloths for a triangular sail, square from leech to tack (*a* to *b*), as shown by foresail (Fig. 7), which gives 38 ft. Add the number of seams and tablings thereto for total length, and divide by whatever width of canvas is used.

If the sheet is above the tack, from square line of leech, it should be treated as shown by drawing of jib, carrying leech line down from sheet (*b*), and squaring from thence to the tack. The line from *c* to *d* indicates the breadth, to which add seams and tablings, and divide by the width of canvas.

To calculate the number of cloths required for cutter yacht's mainsails (Figs. 3 and 4) upon 18-in. canvas :—

For the head add together—

	Feet.	Inches.
Length of Line *a* to *d*	42	0
27 Seams 1¼ inch wide	2	10
Leech and Mast Tablings	0	8
3 Additional Seams	0	4
Reduce to inches	45	10
	12	
Width of Canvas ... 18)	550	
No. of Cloths	30	10=30½ full

For the foot add together—

	Feet.	Inches.
Length of Line *b* to *g*	58	0
38 Seams 1¼ inch wide	4	0
Leech and Mast Tablings	0	8
3 Additional Seams	0	4
Reduce to inches	63	0
	12	
Width of Canvas ... 18)	756	
No. of Cloths	42	

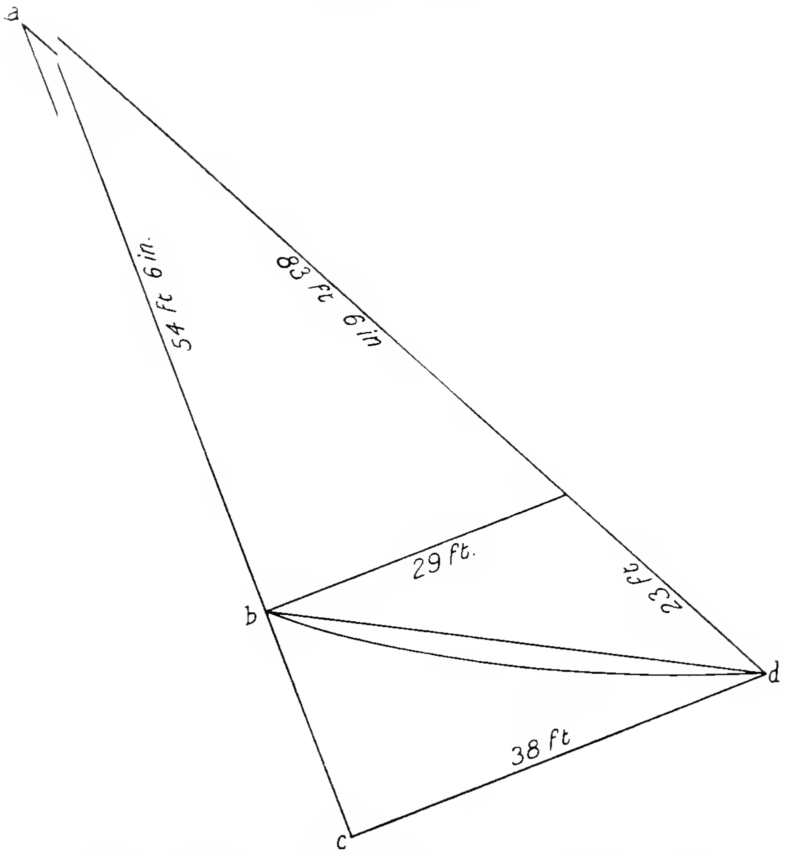
To calculate the number of cloths required for yawl's mainsail (Fig. 5) upon 12-in. canvas :—

For the head add together—

	Feet	Inches.
Length of Line *a* to *d*	35	8
35 Seams 1⅛ inch wide	3	3½
Leech and Mast Tablings	0	8
4 Additional Seams	0	5½
No. of Cloths	40	1=40 full.

Fig. 15.—JIB (ordinary cut).

(Scale, $\frac{1}{16}$ in. per foot.)



Showing method of calculating number of cloths required for the foot, also showing amount of stay gore necessary.

For the foot add together—

	Feet.	Inches.
Length of Line *b* to *g*	48	0
47 Seams 1⅛ inch wide	4	5
Leech and Mast Tablings	0	8
5 Additional Seams	0	6½
No. of Cloths	53	7½=53⅜ bare.

To calculate the number of cloths required for Yawl's mainsail (Fig. 5) upon 18-in. canvas :—

For the head add together—

	Feet.	Inches.
Length of Line *a* to *d*	35	0
22 Seams 1¼ inch wide	2	8½
Leech and Mast Tablings	0	8
3 Additional Seams	0	3¾
Reduce to inches	38	8¼
	12	
Width of Canvas ... 18)	464¼	
No. of Cloths	25	14¼=25⅘ full.

For the foot add together—

	Feet.	Inches.
Length of Line *b* to *g*	48	0
31 Seams 1¼ inch wide	3	3
Leech and Mast Tablings	0	8
3 Additional Seams	0	4
Reduce to inches	52	3
	12	
Width of Canvas ... 18)	627	
No. of Cloths	34	15=34¾ full.

To calculate the number of cloths required for Barge's sprit mainsail (Fig. 6) upon 24-in. canvas :—

For the head add together—

	Feet.	Inches.
Length of Line *a* to *d*	27	0
12 Seams 1⅜ inch wide	1	4½
Leech and Mast Tablings	0	8
2 Additional Seams	0	2¾
Width of Canvas=24 in. 2)	29	3¼
No. of Cloths	14	15¼=14½ full.

For the foot add together—

		Feet.	Inches.
Length of Line *b* to *g*		31	3
14 Seams 1⅜ inch wide		1	7¼
Leech and Mast Tablings		0	8
2 Additional Seams		0	2¾
Width of Canvas = 24 in.	2)	33	9
No. of Cloths		16	21 = 16¾ full.

To calculate the number of cloths required for Yacht's stay foresail (Fig. 7) upon 12-in. canvas :—

For the foot add together—

	Feet.	Inches.
Length of Line *b* to *c*	38	0
37 Seams 1⅛ inch wide	3	4⅝
Leech and Stay Tablings	0	8
5 Additional Seams	0	5⅝
No. of Cloths	42	6¼ = 42 full.

To calculate upon 18-in. canvas :—

For the foot add together—

		Feet.	Inches.
Length of Line *b* to *c*		38	0
24 Seams 1¼ inch wide		2	6
Leech and Stay Tablings		0	8
3 Additional Seams		0	3¾
Reduce to inches		41	5¾
		12	
Width of Canvas	18)	497¾	
No. of Cloths		27	11¾ = 27⅔ bare.

To calculate the number of cloths required for jib (ordinary cut) (Figs. 8 and 15) upon 24-in. canvas :—

For the foot add together—

		Feet.	Inches.
Length of Line *c* to *d*		38	0
18 Seams ¾ inch wide		1	1½
Leech and Stay Tablings		0	3
1 Additional Seam		0	0¾
Width of Canvas = 24 in.	2)	39	5¼
No. of Cloths		19	17¼ = 19⅔ bare.

To calculate the number of cloths required for diagonal jib (Fig. 9) upon 24-in. canvas :—

		Feet.	Inches.
Length of Line *a* to *b*		21	6
10 Seams ¾ inch wide		0	7½
Leech and Stay Tablings		0	6
1 Additional Seam		0	0¾
Width of Canvas=24 in.	2)	22	8¼
No. of Cloths		11	8¼=11½ bare.

To calculate the number of cloths required for yard topsail (Fig. 10) upon 24-in. canvas :—

For the head add together—

		Feet.	Inches.
Length of Line *a* to *c*		33	0
15 Seams 1 inch wide		1	3
Leech and Mast Tablings		0	8
1 Additional Seam		0	1
Width of Canvas=24 in.	2)	35	
No. of Cloths		17	12=17½

For the foot add together—

		Feet.	Inches.
Length of Line from square of Leech to Tack		39	0
19 Seams 1 inch wide		1	7
Leech and Mast Tablings		0	8
1 Additional Seam		0	1
Width of Canvas=24 in.	2)	41	4
No. of Cloths		20	16=20¾ bare.

To calculate the number of cloths required for jib-headed topsail (Fig. 11) upon 18-in. canvas :—

For the foot add together—

		Feet.	Inches.
Length of Line *c* to *d*		40	0
27 Seams 1 inch wide		2	3
Leech and Mast Tablings		0	8
1 Additional Seam		0	1
Reduce to inches		43	
		12	
Width of Canvas	18)	516	
No. of Cloths		28	12=28⅔

Calculated upon 24-in. canvas :—

		Feet.	Inches.
Length of Line *c* to *d*		40	0
19 Seams 1 inch wide		1	7
Leech and Mast Tablings		0	8
1 Additional Seam		0	1
Width of Canvas=24 in.	2)	42	4
No. of Cloths		21	4=21¼ bare.

To calculate the number of cloths required for Barge's topsail (Fig. 12) upon 24-in. canvas :—

For the foot add together—

		Feet.	Inches.
Length of Line *c* to *h*		32	0
16 Seams 1 inch wide		1	4
Leech and Mast Tablings		0	8
Width of Canvas=24 in.	2)	34	0
No. of Cloths		17	

For the head add together—

		Feet.	Inches.
Length of Line		8	0
3 Seams 1 inch wide		0	3
Leech and Mast Tablings		0	8
Width of Canvas=24 in.	2)	8	11
No. of Cloths		4	11=4½ bare.

To calculate the number of cloths required for balance lug (Fig. 13) upon 12-in. canvas :—

For the head add together—

	Feet.	Inches.
Length of Line *a* to *b*	11	0
10 Seams ¾ inch wide	0	7½
Leech and Mast Tablings	0	5
1 Additional Seam	0	0¾
No. of Cloths	12	1¼=12 full.

For the foot add together—

	Feet.	Inches.
Length of Line *c* to *d*	14	8
13 Seams ¾ inch wide	0	9¾
Leech and Mast Tablings	0	5
2 Additional Seams	0	1½
No. of Cloths	16	0¼=16 full.

To calculate the number of cloths required for lug (Fig. 14) upon 12-in. canvas :—

For the head add together—

	Feet.	Inches.
Length of Line *a* to *b*	13	6
13 Seams ¾ inch wide	0	9¾
Leech and Mast Tablings	0	5
1 Additional Seam	0	0¾
No. of Cloths	14	9½=14¾ full.

For the foot add together—

	Feet.	Inches.
Length of Line *c* to *d*	16	8
16 Seams ¾ inch wide	1	0
Leech and Mast Tablings	0	5
1 Additional Seam	0	0¾
No. of Cloths	18	1¾=18¼ bare.

To find the number of mast gores required for a sail, as for instance Fig. 3, subtract the number of the head from the foot cloths, as follows :—

No. of Cloths	Foot	42
	Head	30½
	Mast	11½

CHAPTER VI.

ON ALLOWANCES.

QUOTATION FROM KIPPING'S TREATISE ON "SAILS AND SAILMAKING"—ALLOWANCES FOR CUTTER YACHT'S MAINSAIL (ROUND FOOT), CUTTER YACHT'S MAINSAIL (LACED FOOT), YAWL YACHT'S MAINSAIL, BARGE'S SPRIT MAINSAIL, YACHT'S STAY FORESAIL, JIB (ORDINARY CUT), JIB (DIAGONAL CUT), YARD TOPSAIL, JIB-HEADED TOPSAIL, BARGE'S TOPSAIL, BALANCE LUG AND LUG SAIL.

THE allowances necessary to be made upon certain parts of sails in consequence of the stretching tendency of the canvas, as given in this chapter, can be relied upon, as they have been arrived at by close observation of the best sails manufactured, after being in use.

Mr. R. Kipping, in his elementary treatise on "Sails and Sailmaking," says:—"There cannot be a question but that the sailing qualities of a vessel materially depend upon *flat sails,* and particularly on fore and aft sails that will trim close to the wind. It would be a waste of words to dwell on the many advantages resulting from vessels having flat sails, the signal victory of the far-famed American yacht over the Royal Yacht Squadron having for ever settled their superiority. Not but that years before, the advantage that would be gained by flat sails was known to nautical men; but sailmakers were ignorant of the principles on which sails to stand flat must be constructed; and, even at the present day, several cut their sails to bag in the middle, although it is known that such bagging gives the wind a less power, especially when sailing close-hauled, for the parts so bagging out, being scarcely struck at all by the wind, are filled only with eddies from the adjoining parts of the sail, which eddies have no force at all. Moreover, the flat sail catches more wind than the concave one, even though the concave one be larger; for the wind strikes perpendicularly upon all the parts of the former, but to the latter only a pressure in proportion to the angles of incidence is given."

The same writer goes on to say that it is evident that these baggy sails could not be produced if proper allowances were made. There can be no question as to the truth of this statement, but if he had given the lines upon which the allowances were needed, and a principle by which a correct calculation could be made, the majority of sail-makers would not have been left in error upon the point.

Science proves that all strains work upon direct lines, the nearest or shortest from where strain is applied to a fixed point, and as the gores of sails stretch when pressed by the wind on account of their position, allowances are necessary.

It must be understood that the allowances given in this chapter are exactly what are required for the sails and parts of same specified. Other allowances—such as the difference of the tack away from the mast, or on account of anything hindering the clews of the sails going out to the extreme end of the boom—should be made when the sails are set off. Care must be taken to make allowance for the cringles, if they project out beyond the sail.

In large sails it is advisable, when calculating the cloths, not to reckon anything for the mast tabling, as 3 or 4 in. short upon the spars is not so serious a matter as being 1 in. too long.

MAINSAIL. FIG. 3.

The allowance to be made upon the head of this sail for the giving out upon the gaff is at the rate of 2 in. per foot of the peak gore, less the amount of slack in seams. The peak gore being 21 ft. the slack to be taken in is 4 ft., which subtracted from 21 leaves 17;

therefore the head of the sail will stretch 34 in. This 34 in. is taken in by the seams upon the head, in addition to the body seam, from the square line of throat to leech (*d* to *a*) less 3 in., which should be gradually creased in upon the leech tabling down to the square line upon leech (*a*).

The allowance for the giving out of the upper part of the leech is shown upon plan of sail, and is about 12 in., which should be reduced in the calculation of the gores and tablings.

The amount of stretching of the leech at the clew may be ascertained from the illustration, and will be found to be about 12 in.

The allowance for the giving out upon the boom is 3 in. per foot of the clew gore, which is 16 ft., and will stretch 48 in., which must be taken in by the seams over and above that of the body seams, starting from the tack (*g*), and leading across by the square line (*g* to *b*) until the diagonal line (*d* to *f*) is reached. The seams should then be creased, leading down inside of the diagonal line, so that no seam is over the width of body seam outside of the diagonal line. The 48 in. must be taken in by the seams upon the line from tack to clew (*g* to *f*) less 3 in., which should be rubbed in upon the leech tabling from square line (*c* to *f*).

The allowance to be made for the round of the foot is at the rate of 6 in. per foot of round, from the line of tack to clew (*g* to *f*) to the lower part of sail, which is 6 ft. (*h* to *i*), therefore it is necessary that the seams be creased upon the foot 36 in. wider than the seams upon the line *g* to *f*.

The allowance to the mast of the sail for the giving out should be calculated by reckoning the mast rope to stretch 4 in. per yard; then calculating the amount of slack cloth taken in and the difference of what the rope will give out over that of the slack taken in, which will be the amount of the giving out in length of the mast.

Supposing there is 13 and ⅓rd yards of rope—stretching at the rate of 4 in. per yard, amounting to 53½ in.—the rope should be sewn on as shown by the following Table, which gives 47 in. of slack cloth:—

Rope.	Slack Cloth.
Yards.	Inches.
1	5
2	4¾
3	4½
4	4¼
5	4
6	3¾
7	3½
8	3¼
9	3
10	2¾
11	2½
12	2¼
13	2
13⅔	1½
	47
Give out upon the Mast	6½
	53½

The allowance for the pressure of the wind upon the centre of the sail is made by hollowing the mast a quarter of an inch per foot of the width of the sail, from mast to leech, in line of centre, as shown by the star, and adding ¼ in. per foot of the clew gore. The width of the sail at that point is 50 ft., add the 16 ft. of clew gore, making 66 ft., ¼ in. per foot of which amount gives 16½ in. hollow to the mast.

The allowance for the pressure of the wind against the peak halyards from the centre is met by rounding the head at the rate of ¼ in. per foot of length of the gaff, which is 47 ft., therefore the head should be rounded 11¾ in. The throat of the sail requires to be rubbed in from the first head hole, to the extent of the length of the bolt from gaff, to where the sail will be attached, and also from the upper mast hole. There is more strain at the clew of a mainsail upon the angle or gore of the canvas than at any other part, the stretching tendency of which is 3 in. per foot of the clew gore.

It will be observed that the following Table of Seams for Mainsail (Fig. 3) contains two calculations for the foot of the sail, these being required on account of the round to the same, as the stretch of the sail along the boom is direct upon the line of tack.

It will be seen from illustration that the round of foot is gored both ways, and therefore a double calculation is needed to that of the clew gore, viz., 6 in. per foot of round, which is 6 ft.

ALLOWANCE TO MAINSAIL.

(Fig. 3) Calculated upon 18-in. Canvas.

The following Table of Seams gives the allowances required for the giving out of the sail upon the head and foot, exclusive of Body Seams.

No. of Seams.	Head Seams. Inches.	Foot Seams. Inches.	Foot (Round) Seams. Inches.
1	⅛	⅛	¼
2	¼	¼	½
3	¼	⅜	⅝
4	⅜	½	¾
5	⅜	⅝	⅞
6	½	¾	⅞
7	½	¾	⅞
8	⅝	¾	⅞
9	⅝	¾	1
10	¾	1	1
11	¾	1	1
12	⅞	1	1
13	⅞	1⅛	1
14	1	1¼	1
15	1	1¼	1
16	1	1⅜	1
17	1⅛	1⅜	1⅛
18	1⅛	1½	1⅛
19	1¼	1½	1⅛
20	1¼	1½	1¼
21	1⅜	1½	1¼
22	1⅜	1⅝	1¼
23	1½	1⅝	1¼
24	1½	1⅝	1⅛
25	1⅝	1¾	1⅛
26	1⅝	1¾	1⅛
27	1¾	1¾	1
28	1¾	1⅞	1
29	1⅞	1¾	1
30	1⅞	2	1
31	3 { Leech Tabling	2	⅞
32	34	1¾	⅞
33	...	1½	¾
34	...	1	¾
35	...	¾	¾
36	...	⅝	¾
37	...	½	⅝
38	...	⅜	½
39	...	¼	⅜
40	...	⅛	¼
41	...	⅛	⅛
42	...	3 { Leech Tabling	
		48	36

ALLOWANCE TO MAINSAIL

(Fig. 3) Calculated upon 12-in. Canvas.

The undermentioned Table of Seams gives the allowances required for the giving out of the sail upon the head and foot, exclusive of Body Seams.

No. of Seams.	Head Seams. Inches.	Foot Seams. Inches.	Foot (Round) Seams. Inches.
1	1/16	1/8	1/8
2	1/8	1/8	1/8
3	1/4	1/8	1/4
4	1/4	1/8	1/4
5	1/4	1/8	3/8
6	1/4	1/8	3/8
7	3/8	1/4	3/8
8	3/8	1/4	3/8
9	3/8	1/4	1/2
10	3/8	1/4	1/2
11	3/8	3/8	1/2
12	3/8	3/8	1/2
13	1/2	3/8	1/2
14	1/2	3/8	1/2
15	1/2	3/8	1/2
16	1/2	3/8	1/2
17	1/2	1/2	5/8
18	1/2	1/2	5/8
19	1/2	1/2	5/8
20	1/2	1/2	5/8
21	5/8	5/8	5/8
22	5/8	5/8	5/8
23	5/8	5/8	5/8
24	5/8	5/8	5/8
25	5/8	3/4	3/4
26	5/8	3/4	3/4
27	3/4	3/4	3/4
28	3/4	3/4	3/4
29	3/4	7/8	3/4
30	3/4	7/8	3/4
31	3/4	7/8	3/4
32	3/4	7/8	3/4
33	7/8	1	3/4
34	7/8	1	3/4

No. of Seams.	Head Seams. Inches.	Foot Seams. Inches.	Foot (Round) Seams. Inches.
35	7/8	1	7/8
36	7/8	1	7/8
37	1	1	7/8
38	1	1	7/8
39	1	1	7/8
40	1 1/8	1	7/8
41	1 1/8	1	7/8
42	1 1/8	1 1/8	7/8
43	1 1/8	1 1/8	7/8
44	1 1/4	1 1/8	7/8
45	1 1/4	1 1/4	3/4
46	1 5/16	1 1/4	3/4
47	3 { Leech Tabling	1 3/8	3/4
48	34	1 3/8	3/4
49	...	1 3/8	3/4
50	...	1 3/8	5/8
51	...	1 1/4	5/8
52	...	1 1/8	1/2
53	...	1 1/8	3/8
54	...	1	3/8
55	...	1	3/8
56	...	7/8	3/8
57	...	3/4	3/8
58	...	5/8	1/4
59	...	1/2	1/4
60	...	3/8	1/4
61	...	1/4	1/4
62	...	1/8	1/8
63	...	1/8	...
		3 { Leech Tabling	
		48	36

MAINSAIL. FIG. 4.

This sail is the same in size as the one already described, but, being a lace foot sail, it differs in its construction.

The allowance for the giving out of the head is at the rate of 2 in. per foot of the peak gore, which is 21 ft.; and there being no slack taken in the seams, the total length of the gore must be calculated, giving 42 in., which is treated in the same way as No. 3 mainsail, and creased upon the seams beyond the body seams, except 4 in., which can be rubbed in upon the leech tabling.

The amount of the stretch upon the boom is 2 in. per foot of the clew gore, the gore is 16 ft., therefore it will give out 32 in. The seams must be creased this much wider than the body seam, regarding the diagonal line, in the same manner as mainsail No. 3.

The foot must be rubbed directly straight.

The giving out of the mast is treated as on No. 3 mainsail. The allowance for the pressure upon the centre of sail is at the rate of ¼ in. per foot of the width at centre. The clew gore is not added in this case, as there is no slack, and the strain upon the foot is different to a round foot mainsail. The allowance for the round of head is at the same rate as that of No. 3 mainsail.

It should be mentioned that this sail, although it may be made very flat, is not so conducive to speed, when a vessel is close-hauled, as a properly constructed round-foot sail, there being no freedom at the foot for the pressure of the wind at the centre, because it is laced upon the boom. There is almost an equal strain along the boom, and the principle upon which the sail is made renders the strains such that no slack seams can be effectively taken in from the centre, for a freedom of the wind out of the after leech.

ALLOWANCE TO MAINSAIL

(FIG. 4) CALCULATED UPON 12-IN. CANVAS.

The following Table of Seams gives the necessary allowances for the stretching of the sail upon the head and foot, not including the Body Seams.

No. of Seams.	Head Seams. Inches.	Foot Seams. Inches.
1	$\frac{1}{8}$	$\frac{1}{16}$
2	$\frac{1}{4}$	$\frac{1}{16}$
3	$\frac{1}{4}$	$\frac{1}{8}$
4	$\frac{3}{8}$	$\frac{1}{8}$
5	$\frac{3}{8}$	$\frac{1}{4}$
6	$\frac{3}{8}$	$\frac{1}{4}$
7	$\frac{3}{8}$	$\frac{1}{4}$
8	$\frac{1}{2}$	$\frac{1}{4}$
9	$\frac{1}{2}$	$\frac{1}{4}$
10	$\frac{1}{2}$	$\frac{1}{4}$
11	$\frac{1}{2}$	$\frac{1}{4}$
12	$\frac{5}{8}$	$\frac{1}{4}$
13	$\frac{5}{8}$	$\frac{1}{4}$
14	$\frac{5}{8}$	$\frac{3}{8}$
15	$\frac{5}{8}$	$\frac{3}{8}$
16	$\frac{3}{4}$	$\frac{3}{8}$
17	$\frac{3}{4}$	$\frac{3}{8}$
18	$\frac{3}{4}$	$\frac{3}{8}$
19	$\frac{3}{4}$	$\frac{3}{8}$
20	$\frac{3}{4}$	$\frac{3}{8}$
21	$\frac{7}{8}$	$\frac{3}{8}$
22	$\frac{7}{8}$	$\frac{3}{8}$
23	$\frac{7}{8}$	$\frac{3}{8}$
24	$\frac{7}{8}$	$\frac{1}{2}$
25	$\frac{7}{8}$	$\frac{1}{2}$
26	1	$\frac{1}{2}$
27	1	$\frac{1}{2}$
28	1	$\frac{1}{2}$
29	1	$\frac{1}{2}$
30	1	$\frac{1}{2}$
31	1	$\frac{1}{2}$
32	1	$\frac{1}{2}$
33	$1\frac{1}{8}$	$\frac{1}{2}$
34	$1\frac{1}{8}$	$\frac{5}{8}$
35	$1\frac{1}{8}$	$\frac{5}{8}$
36	$1\frac{1}{8}$	$\frac{5}{8}$
37	$1\frac{1}{8}$	$\frac{5}{8}$
38	$1\frac{1}{4}$	$\frac{3}{4}$
39	$1\frac{1}{4}$	$\frac{3}{4}$
40	$1\frac{1}{4}$	$\frac{3}{4}$
41	$1\frac{1}{4}$	$\frac{3}{4}$
42	$1\frac{1}{4}$	$\frac{3}{4}$
43	$1\frac{3}{8}$	$\frac{3}{4}$
44	$1\frac{3}{8}$	$\frac{7}{8}$
45	$1\frac{3}{8}$	$\frac{7}{8}$
46	4 Leech Tabling	$\frac{7}{8}$
47		$\frac{7}{8}$
48	42	$\frac{7}{8}$
49	...	$\frac{7}{8}$
50	...	$\frac{3}{4}$
51	...	$\frac{3}{4}$
52	...	$\frac{5}{8}$
53	...	$\frac{5}{8}$
54	...	$\frac{1}{2}$
55	...	$\frac{1}{2}$
56	...	$\frac{3}{8}$
57	...	$\frac{3}{8}$
58	...	$\frac{1}{4}$
59	...	$\frac{1}{4}$
60	...	$\frac{1}{8}$
61	...	$\frac{1}{8}$
62	...	$\frac{1}{16}$
63	...	$\frac{1}{16}$
	Leech Tabling	3
		32

ALLOWANCE TO MAINSAIL

(Fig. 4) Calculated upon 18-in. Canvas.

The following Table of Seams gives the allowances required for the giving out of the sail upon the head and foot exclusive of Body Seams.

No. of Seams.	Head Seams. Inches.	Foot Seams. Inches.
1	⅛	⅛
2	¼	¼
3	⅜	¼
4	½	⅜
5	⅝	⅜
6	⅝	⅜
7	¾	⅜
8	¾	½
9	⅞	½
10	⅞	½
11	1	½
12	1	⅝
13	1⅛	⅝
14	1⅛	⅝
15	1¼	¾
16	1¼	¾
17	1⅜	¾
18	1⅜	¾
19	1½	⅞
20	1⅝	⅞
21	1⅝	1
22	1¾	1
23	1¾	1
24	1⅞	1
25	1⅞	1
26	2	1
27	2	1
28	2⅛	1⅛
29	2¼	1⅛
30	2⅜	1⅛
31	4 Leech Tabling	1⅛
32	42	1⅛
33	...	1⅛
34	...	1
35	...	⅞
36	...	¾
37	...	⅝
38	...	½
39	...	⅜
40	...	¼
41	...	⅛
42		Leech Tabling 3
		32

Yawl's Mainsail (Fig. 5).

The allowances required for the giving out of this sail upon the head are at the same rate as those previously described, less the amount of slack taken in by the seams, which is 2 ft. 3 in.

The amount which the leech will stretch at the peek and clew is shown upon the plan of sail.

The allowance for the giving out of the foot is at the rate of 3 in. per foot of the clew gore, which is 9 ft., therefore 27 in. is the amount the sail will stretch along the boom. This is taken in by the seams in the line from tack to clew, starting upon the square line from tack to leech (*g* to *b*) until the diagonal line is reached, and leading down inside.

ALLOWANCE TO MAINSAIL

(Fig. 5) Calculated upon 18-in. Canvas.

The undermentioned Table of Seams gives the allowances required for the giving-out of the sail upon the head and foot, exclusive of the body seams:—

No. of Seams.	Head Seams. Inches.	1st Foot Seams. Inches.	Foot (Round) Seams. Inches.
1	⅛	⅛	⅛
2	¾	¼	¼
3	⅞	⅜	⅜
4	1	⅜	⅜
5	1	⅜	⅜
6	1⅛	½	½
7	1⅛	½	½
8	1¼	½	½
9	1 [illegible]	½	⅝
10	1¼	⅝	⅝
11	1⅜	⅝	¾
12	1⅜	¾	¾
13	1½	¾	⅞
14	1½	¾	⅞
15	1½	⅞	⅞
16	1½	⅞	⅞
17	1⅝	⅞	1
18	1¾	1	1
19	1¾	1	1⅛
20	1⅞	1⅛	1⅛
21	1⅞	1⅛	1⅛
22	2	1⅛	1⅛
23	2	1⅛	1
24	2⅛	1⅛	⅞
25	2⅛	1⅛	⅞
26	4 Leech Tabling	1¼	⅞
27	40	1¼	¾
28	...	1¼	¾
29	...	1	⅝
30	...	1	⅝
31	...	¾	½
32	...	½	½
33	...	⅜	⅜
34	...	¼	¼
35	...	1 Leech Tabling	
		27	24

For the round of foot the seams must be creased 6 in. per foot of round, which is 4 ft., therefore the seams must be creased 24 in. wider upon the foot than upon the line from tack to clew (*g* to *f*).

The mast should be treated in the same manner as the sails already mentioned.

The allowance for the pressure of the wind upon the centre is made by hollowing the mast a ¼ in. per foot of the width of the sail at the centre, and adding the clew gore.

ALLOWANCE TO MAINSAIL

(Fig. 5) Calculated upon 12-in. Canvas.

The following Table of Seams gives the allowances required for the giving-out of the sail upon the head and foot, exclusive of body seams :—

No. of Seams.	Head Seams. Inches.	1st Foot Seams. Inches.	Foot (Round) Seams. Inches.
⅔	⅛	0	0
1	⅛	1/16	⅛
2	¼	⅛	¼
3	¼	⅛	¼
4	¼	⅛	⅜
5	⅜	¼	⅜
6	⅜	¼	⅜
7	⅜	¼	⅜
8	½	¼	½
9	½	¼	½
10	½	¼	½
11	⅝	⅜	½
12	⅝	⅜	½
13	⅝	⅜	½
14	¾	⅜	½
15	¾	⅜	⅝
16	¾	⅜	⅝
17	⅞	⅜	⅝
18	⅞	½	⅝
19	⅞	½	⅝
20	1	½	⅝
21	1	½	⅝
22	1⅛	½	⅝
23	1⅛	½	⅝
24	1⅛	½	⅝
25	1¼	½	⅝
26	1¼	⅝	⅝
27	1⅜	⅝	⅝
28	1⅜	⅝	⅝
29	1⅜	⅝	⅝
30	1⅜	⅝	⅝
31	1⅜	⅝	⅝
32	1½	¾	⅝
33	1½	¾	½
34	1½	¾	½
35	1½	¾	½
36	1⅝	¾	½
37	1⅝	¾	½
38	1⅝	¾	½
39	4 Leech Tabling	⅞	½
40	40	⅞	½
41	...	⅞	⅜
42	...	⅞	⅜
43	...	⅞	⅜
44	...	¾	⅜
45	...	¾	⅜
46	...	⅝	⅜
47	...	½	⅜
48	...	⅜	¼
49	...	¼	¼
50	...	⅛	⅛
51	...	⅛	⅛
52	...	1/16	0
53	...	1 Leech Tabling	
		27	24

The sail measures at the centre 41 feet; the clew gore is 9 ft., making 50 ft.; therefore the mast needs hollowing 12½ in.

The head needs to be rounded a $\frac{1}{4}$ in. per foot of the length of gaff.

An allowance for the throat bolt must be made, if necessary.

BARGE'S SPRIT MAINSAIL (FIG. 6).

The allowance for the giving out of the head of the above sail is 2 in. per foot of the peek gore, shown at 24 ft., less the amount of slack taken in—viz., 7$\frac{1}{2}$ in.—which is at the rate of 3 in. per foot of the clew gore; therefore the amount that the head will stretch is 46$\frac{3}{4}$ in. This amount must be taken in by the seams, from the square line of the throat, beyond that of the body seams less 5 in., which may be creased in upon the leech tabling.

The giving out of the leech may be ascertained from the illustration. The foot will stretch at the rate of 3 in. per foot of the clew gore, which must be taken in by the seams in the bend from the tack to clew, less 1 in. to be rubbed in upon the leech tabling.

The allowance for the round of foot from the line of tack to clew is 6 in. per foot of round over and above the width of seam upon the line of tack to clew, which must be taken in by the foot seams.

The hollow to the mast required is a $\frac{1}{4}$ in. per foot of the square of sail from the centre of effort, adding a $\frac{1}{4}$ in. per foot of the clew gore, making 7$\frac{1}{2}$ in.

The slack must be taken in from the centre of effort, the greater part towards the peek. The head of the sail should be spread straight. The peek should be rubbed in for the earing of head rope, from the line of head, half the amount of the size in circumference of the log of spirit.

The only peculiarity of this sail is that the head rope requires to be much larger than other sails, in proportion to the strain applied. The sail when stowed is brailed up, so that the head rope is exposed to all weathers, and when the mast is lowered the rope has to bear the weight of the sprit and gear; therefore the safety of life and property is dependent upon the strength of the rope used.

ALLOWANCE FOR MAINSAIL

(Fig. 6) Calculated upon 24-in. Canvas.

The following Table of Seams gives the allowances necessary for the stretching of the sail upon the head and foot, not including the body seams :—

No. of Seams.	Head Seams. Inches.	1st Foot Seams. Inches.	Foot (Round) Seams. Inches.
1	1¼	0	⅛
2	2	⅛	¼
3	2¼	¼	⅜
4	2½	⅜	½
5	2¾	⅜	⅝
6	3	½	¾
7	3⅛	½	⅞
8	3¼	⅝	1
9	3⅜	⅝	1
10	3½	¾	1
11	3⅝	¾	1
12	3⅝	⅞	⅞
13	3¾	1	¾
14	3¾	¾	⅝
15	5 Leech Tabling	¼	½
16	46¾	0	¼
		¾ Leech Tabling	10½
		8½	

The tables of allowances given for the mainsails, shown by drawings and calculated therefrom, can safely be relied upon. The proportion of the allowances is the same as required for all similar made sails, whether large or small, providing the canvas used is of the best material and of a suitable number for such sails. It matters little whether flax or cotton canvas is used, if it is of fair weight for the sail in accordance to the size of the vessel and the work expected of it, as the manufacture of the materials is the same, there being no appreciable difference in the stretching tendency.

The cause of the giving out is the displacement of the threads of the canvas, in consequence of the wind plying upon the angle of the cloth. It does not matter whether the rope is put on tight or not at such parts. In respect to the head of a mainsail, the canvas will stretch upon the gore, and if the rope is not put on to allow for the giving out, the slack cloth will be seen and the sail will be rope-bound. It is not merely in this particular that the sail will be faulty, for if the calculation is not correctly made for the stretching of the gores, it will not only be uneven but short upon the square lines from the throat to leech, and from tack to leech.

It is important—especially for racing yachts—that such lines be out to their full extent, as the spars are calculated upon for the rating of the same. Therefore it is a great advantage to have a full sail at centre. It makes no difference whether sails are made of 24, 18 or 12-in. canvas, as the allowances given apply to all if a heavier number is used in case of wider canvas (*see* Chapter I.). The amount of the slack seams can be relied upon, if the quantity is proportioned at the rate of 3 in. per foot of the clew gore.

YACHT'S STAY FORESAIL (FIG. 7) CALCULATED UPON 12-IN CANVAS.

It will be seen that the clew gore of the sail is 2 ft. 6 in. The foot will give out at the rate of 2 in. per foot of the gore, therefore the total stretch is 5 in. upon the line from the tack to clew (*c* to *d*). The seams must be creased—this 5 in. wider upon that line than that of the body seams. The round to the foot shown at 2 ft. being a double gore and cut both ways, requires the seams to be creased 4 in. per foot of round beyond that of the seams upon the line from the clew to tack (*d* to *c*).

The calculation of the allowances necessary for the seams is as follows :—

No. of Seams.	Foot Seams. 1st. Inches.	Foot Seams. 2nd. Inches.	No. of Seams.	Foot Seams. 1st. Inches.	Foot Seams. 2nd. Inches.
1	0	0	23	1/8	5/16
2	0	1/16	24	1/8	5/16
3	0	1/16	25	3/16	5/16
4	0	1/8	26	3/16	5/16
5	0	1/8	27	3/16	5/16
6	1/16	1/8	28	3/16	5/16
7	1/16	1/8	29	3/16	1/4
8	1/16	1/8	30	3/16	1/4
9	1/16	1/8	31	3/16	1/4
10	1/16	1/8	32	3/16	1/4
11	1/16	3/16	33	3/16	1/4
12	1/16	3/16	34	3/16	1/4
13	1/16	3/16	35	1/4	3/16
14	1/16	3/16	36	1/4	3/16
15	1/16	3/16	37	1/4	1/8
16	1/8	3/16	38	1/4	1/8
17	1/8	1/4	39	1/4	1/8
18	1/8	1/4	40	1/8	1/8
19	1/8	1/4	41	1/16	1/16
20	1/8	1/4	42	1/16	1/16
21	1/8	1/4		5	8
22	1/8	1/4			

The stretching of the stay is calculated from the size of the rope put on. The size of this stay rope is 3 in., but the strain applied to the stay is insufficient to stretch the rope to its full extent. It will give out at the rate of 2½ in. per yard of its length, and if sewn on in the proportion of the slack cloth given below, it will stretch upon the stay about 9 in.

Taking the length of stay, and deducting the amount of slack cloth to be taken in, gives 18 yards of rope, which will give out 2½ in. per yard, therefore the total stretch is 45 in.

The stay rope is to be sewn on as under :—

Rope. Yards.	Slack Cloth. Inches.	Rope. Yards.	Slack Cloth. Inches.
1	3	12	1¾
2	3	13	1½
3	2¾	14	1½
4	2¾	15	1¼
5	2½	16	1¼
6	2½	17	1
7	2¼	18	1
8	2¼		36
9	2	Give out upon Stay	9
10	2		45
11	1¾		

The allowance for the pressure of wind upon the centre of sail is made by hollowing the stay a ¼ in. per foot of the width of sail at centre, viz., 26 feet, add the clew gore 2½ feet, making 28½ feet, a ¼ in. per foot of which gives 7⅛ in., the amount of hollow needed.

The head of sail should be rubbed down from the upper stay hole to the extent of any difference between the fore halyard bolt to which the blocks are attached and the stay above, allowing for the difference of breadth of hank. A similar allowance should be made at the tack of sail if fixed within the stay.

Slack can be advantageously taken in by the seams from centre, at the rate of 3 in. per foot of the clew gore. In this case the amount to be taken in is 7½ in., but if the clew is square with the tack, no slack is required.

The leech tabling at the head should be creased in 4 in. more than the width at centre.

There being but one illustration of a foresail given and calculated upon, it must be understood that the same proportion of allowances as given for this foresail are required for all sails of similar shape, when the clews are below the tack upon the square line of leech. Such sails, whether foresails or staysails, need hollow to the stay, but should the clew be above the square of tack, the stay should be treated as a jib, with a flow to stay, upon the square line of sheet at the same proportion as given for jib (ordinary cut), Fig. 6.

ALLOWANCES TO YACHT'S STAY FORESAIL

(Fig. 7) Upon 18-in. Canvas.

The under-mentioned Table of Seams gives the allowances required for the giving out of the sail upon the foot, exclusive of the body seams :—

No. of Seams.	Foot Seams. 1st. Inches.	Foot Seams. 2nd. Inches.	No. of Seams.	Foot Seams. 1st. Inches.	Foot Seams. 2nd. Inches.
$\frac{2}{3}$	0	$\frac{1}{8}$	15	$\frac{5}{16}$	$\frac{3}{8}$
1	$\frac{1}{16}$	$\frac{1}{8}$	16	$\frac{5}{16}$	$\frac{3}{8}$
2	$\frac{1}{16}$	$\frac{1}{8}$	17	$\frac{1}{4}$	$\frac{3}{8}$
3	$\frac{1}{8}$	$\frac{1}{4}$	18	$\frac{1}{4}$	$\frac{3}{8}$
4	$\frac{1}{8}$	$\frac{1}{4}$	19	$\frac{3}{16}$	$\frac{3}{8}$
5	$\frac{1}{8}$	$\frac{1}{4}$	20	$\frac{3}{16}$	$\frac{3}{8}$
6	$\frac{3}{16}$	$\frac{1}{4}$	21	$\frac{3}{16}$	$\frac{3}{8}$
7	$\frac{3}{16}$	$\frac{3}{8}$	22	$\frac{1}{8}$	$\frac{1}{4}$
8	$\frac{3}{16}$	$\frac{3}{8}$	23	$\frac{1}{8}$	$\frac{1}{4}$
9	$\frac{1}{4}$	$\frac{3}{8}$	24	$\frac{1}{8}$	$\frac{1}{4}$
10	$\frac{1}{4}$	$\frac{3}{8}$	25	$\frac{1}{8}$	$\frac{1}{8}$
11	$\frac{5}{16}$	$\frac{3}{8}$	26	$\frac{1}{16}$	$\frac{1}{8}$
12	$\frac{5}{16}$	$\frac{3}{8}$	27	$\frac{3}{4}$ Leech Tabling	
13	$\frac{5}{16}$	$\frac{3}{8}$		$5\frac{3}{4}$	8
14	$\frac{5}{16}$	$\frac{3}{8}$			

Jib (Ordinary Cut), (Fig. 8).

The foot of this sail will stretch at the rate of 2 in. per foot of the tack gore, which is 23 feet: the foot will therefore stretch 46 in. Three-quarters of this amount must be taken in by the seams upon the line from the clew to tack (*a* to *d*), on which line the seams must be creased $34\frac{1}{2}$ in. wider than the body seams. The remaining quarter ($11\frac{1}{2}$ in.) should be rubbed in upon the stay, from the line *b* to tack. The round to foot shown at 18 in. must be dealt with by creasing the seams at foot 4 in. per foot of round, therefore the seams should be creased 6 in. wider than upon the line from clew to tack.

The giving out of the stay can only be arrived at by a calculation of the stretching tendency of the rope, using one's judgment as to the proportion of slack cloth required, and considering the relative position of the threads of the canvas according to the direction of the strain applied.

Much "art and science" is necessary in the production of this sail. It is essential to know what size rope is required and how to put it on.

The size of the stay rope is 5 in., which should be reckoned to give out its size in circumference per yard of the length.

After allowing for the slack cloth, there is about 25 yards of rope, which, multiplied by 5, gives 125 in., the amount the rope will stretch.

The stay rope is to be put on as under:—

Rope.	Slack Cloth.	Rope.	Slack Cloth.
Yards.	Inches.	Yards.	Inches.
1	1¾	16	4
2	2¼	17	3¾
3	2¾	18	3½
4	3¼	19	3¼
5	4	20	3
6	4¾	21	2¾
7	5½	22	2½
8	5½	23	2¼
9	5¼	24	2
10	5¼	25	1¾
11	5		92½
12	5	Give out upon Stay	32½
13	4¾		125
14	4½		
15	4¼		

To get the proportion of the stretching of the head or leech to that of the tack, the number of yards of rope should be calculated from the line of strain marked *b* down to tack, deducting the slack cloth. For instance, from the line *b* to tack, after allowing for slack cloth, is

7 yards, which, at 5 in. per yard, is 35 in. The amount of slack cloth taken in is 24¼ in., which subtracted from the 35 in., gives 10¾ in. as the amount the tack will stretch. The upper part is treated in a similar way, and will give out 21¾ in.

ALLOWANCE TO JIB (Ordinary Cut)

(FIG. 8) CALCULATED UPON 24-IN. CANVAS.

The under-mentioned Table of Seams gives the allowances required for the giving out of the sail upon the foot, exclusive of body seams :—

No. of Seams.	Foot Seams. 1st. Inches.	Foot Seams. 2nd. Inches.
½	½	0
1	⅝	0
2	⅞	⅛
3	1	¼
4	1⅛	⅜
5	1¼	⅜
6	1⅜	⅜
7	1½	½
8	1⅝	½
9	1¾	½
10	1¾	½
11	1⅞	½
12	2	½
13	2⅛	⅜
14	2¼	⅜
15	2⅜	⅜
16	2½	¼
17	2⅝	⅛
18	2¾	0
19	2⅞	0
	34¾	6

To find the amount of flow required at the stay, the square line from *a* to *b* should be extended at the rate of a ½ in. per foot of the tack gore, which is 23 ft., therefore it should be carried out 11½ in. beyond the line from the head to tack (*c* to *d*), after which the amount that the foot will give out should be marked off from the tack shown at 46 in. The leech must be marked the amount it will stretch, viz., 21¾ in. ; a line should then be struck from the points *e* to *f*, another line should be marked from *f* to the outer part of line *b* and from thence to *e*. When the sail is spread the flow at stay from the line of head to tack (*f* to *e*) should be about 27 in., as shown upon drawing.

It will be seen by the figures given for the sail that the slack cloth to be taken in upon the stay rope can be easily calculated.

In reference to the tables of ropes, given in Chapter I., the size of the rope is calculated to give out as much per yard as the size in circumference. The first yard at the head and tack is reckoned at about one-third slack canvas to the size of the circumference of the rope, and at the strain or flow upon stay there is a ½ in. more slack cloth per yard than the size of the rope, varying the quantity from the flow the greater to the less.

The seam allowance for the foot is as under :—

CALCULATED UPON 18-IN. CANVAS.

No. of Seams.	Foot Seams. 1st. Inches.	Foot Seams. 2nd. Inches.
1	¼	0
2	⅜	0
3	½	⅛
4	⅝	⅛
5	¾	⅛
6	⅞	¼
7	1	¼
8	1⅛	¼
9	1¼	⅜
10	1¼	⅜
11	1⅜	⅜
12	1⅜	⅜
13	1½	½
14	1½	½
15	1⅝	½
16	1⅝	⅜
17	1¾	⅜
18	1¾	¼
19	1⅞	¼
20	1⅞	¼
21	2	⅛
22	2	⅛
23	2⅛	⅛
24	2⅛	0
25	2¼	0
	34¾	6

DIAGONAL JIB (FIG. 9).

This sail is the same in size as the ordinary cut jib (Fig. 6). The allowance needed upon the stay for the giving out of the length, is arrived at by calculating the amount which the rope will stretch and deducting the amount of slack cloth taken in. For instance, there is 25 yards of clear rope upon the stay, which will give out 5 in. per yard, therefore the total stretch of the rope is 125 ins.

The rope is put on as under:—

Rope. Yards.	Slack Cloth. Inches.	Rope. Yards.	Slack Cloth. Inches.
1	1¾	16	4
2	2	17	4¾
3	2½	18	3½
4	3	19	3¼
5	3½	20	3
6	4	21	2¾
7	4¼	22	2½
8	4¾	23	2¼
9	5	24	2
10	5¼	25	1¾
11	5½		90½
12	5½	Give out upon Stay	34½
13	5¼		125
14	5		
15	4½		

The proportion of the lower part to the upper is arrived at in a similar way to that of the first jib, by deducting the amount of the slack cloth taken in, from what the rope will stretch, from the last upon the stay to head and tack. From the tack to last there is about 11 yards of clear rope, stretching 55 in. The slack cloth taken in is 41½ in., which, deducted from 55 in., leaves 13½ in., the amount the lower part will stretch. For the upper part there is 14 yards of rope, which will give out 70 in., and the amount of slack taken in is 49 in., which, subtracted from 70 in., gives 21 in., the amount the upper part will stretch.

For the amount of flow required, mark upon the foot from tack the amount it will give out, viz., 13½ in. Mark upon the leech the amount from the head what it will stretch (21 in.), marking a line from these points, and extending the last line out at the rate of ½ in. per foot of the last gore, which is 11 ft. 3 in., therefore the last line should be extended 5¾ in. Another line should be struck from line upon the leech and foot to the outer part of the extended last line, as shown upon drawing. When the sail is spread, the amount of flow should be as much as is given from the inner line to the outer, which is about 18 in.

The sheet of the sail will give out at the rate of 1 in. per foot of the last gore, which must be taken in by the seams from the square line to last, with the exception of one-fourth of the amount of stretch, which should be creased in upon leech tabling.

ALLOWANCE TO DIAGONAL JIB.

(Fig. 9) Calculated upon 18 and 24-in. Canvas.

The undermentioned Table of Seams gives the allowances required for the giving out of the sails upon the last, exclusive of Body Seams.

18 Inches.			24 Inches.		
No. of Seams.	Inches.		No. of Seams.	Inches.	
1	⅛		⅓	⅛	
2	¼		1	¼	
3	¼		2	⅜	
4	⅜		3	½	
5	⅜		4	⅝	
6	½		5	¾	
7	½		6	⅞	
8	⅝		7	1	
9	¾		8	1⅛	
10	¾		9	1¼	
11	⅞		10	1⅜	
12	⅞		11	3	Leech Tabling
13	⅞			11¼	
14	1				
15	1				
	2⅜	Leech Tabling			
	11¼				

YARD TOPSAIL (FIG. 10).

The allowances necessary for the stretching of certain parts of this sail are arrived at by finding and marking the centre of gravity, and getting line of pressure by squaring from the mast, striking through the centre across the sail, as the strain is shown to be upon the head. In consequence of the angle of pressure differing upon the threads of the canvas of the sail from that of a mainsail, a difference in the allowance is necessary. If the line of pressure be upon the mast, as is the case in some topsails, the allowance for the stretching of the head will be 2 in. per foot of the peek gore, unless the gore exceed in length the square line from the leech to throat, which in that case the allowance will be calculated at the same rate upon the length of square line at the throat. In this case a line should be struck from the point of pressure upon the head across the sail by the square of leech as shown upon drawing marked *h* and *i*, measuring 28 ft., which must be reduced by the length from the line of pressure, which is at the clew, to the line leading from the point of pressure upon the head to the leech marked *i*, which is 13 ft. 6 in., thus leaving 14 ft. 6 in., the length to be calculated upon for the giving out of the head. The rate of 2 in. per foot gives 29 in. as the amount of stretch, which should be taken in by the seams upon the line *h* to *i*, less 4 in., to be creased in upon the leech tabling. The foot will give out 2 in. per foot of the foot gore, which is 15 ft. 6 in., therefore it will stretch 31 in. This amount should be taken in by the seams commencing at the clew, and following along the line leading towards *d* at the mast, less 4 in., to be creased in upon the mast tabling.

The mast will stretch about 12 in, which shows in the illustration by the line marked from *d* upon the mast down upon the foot inside the tack. This must be allowed for in the roping. The head needs to be rounded at the rate of a $\frac{1}{4}$ in. per foot of the length of the yard. The mast, when rubbed in, should show a fulness at the point *d* of about 9 in. by a line from throat to the tack.

The allowances for the seams are as follows:—

CALCULATED UPON 18-IN. CANVAS.

No. of Seams.	Head. Inches.	1st Foot. Inches.	2nd Foot. Inches.
		$4\frac{1}{2}$ Mast Tabling.	
1		$1\frac{3}{4}$	
2		$1\frac{5}{8}$	$\frac{1}{8}$
3		$1\frac{5}{8}$	$\frac{1}{8}$
4		$1\frac{5}{8}$	$\frac{1}{8}$
5		$1\frac{5}{8}$	$\frac{3}{16}$
6	0	$1\frac{1}{2}$	$\frac{3}{16}$
7	0	$1\frac{3}{8}$	$\frac{3}{16}$
8	0	$1\frac{3}{8}$	$\frac{3}{16}$
9	$\frac{1}{8}$	$1\frac{3}{8}$	$\frac{1}{4}$
10	$\frac{1}{4}$	$1\frac{1}{4}$	$\frac{1}{4}$
11	$\frac{3}{8}$	$1\frac{1}{4}$	$\frac{1}{4}$
12	$\frac{5}{8}$	$1\frac{1}{8}$	$\frac{1}{4}$
13	$\frac{7}{8}$	$1\frac{1}{8}$	$\frac{1}{4}$
14	$1\frac{1}{8}$	$1\frac{1}{8}$	$\frac{5}{16}$
15	$1\frac{1}{4}$	1	$\frac{5}{16}$
16	$1\frac{1}{4}$	$\frac{7}{8}$	$\frac{5}{16}$
17	$1\frac{3}{8}$	$\frac{7}{8}$	$\frac{5}{16}$
18	$1\frac{3}{8}$	$\frac{3}{4}$	$\frac{5}{16}$
19	$1\frac{1}{2}$	$\frac{3}{4}$	$\frac{5}{16}$
20	$1\frac{1}{2}$	$\frac{5}{8}$	$\frac{5}{16}$
21	$1\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{16}$
22	$1\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$
23	$1\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$
24	$1\frac{7}{8}$	$\frac{3}{8}$	$\frac{3}{16}$
25	$1\frac{7}{8}$	$\frac{3}{8}$	$\frac{3}{16}$
26	2	$\frac{1}{8}$	$\frac{1}{8}$
27	2	$\frac{1}{8}$	$\frac{1}{8}$
28	$4\frac{1}{2}$ Leech Tabling		
	29	31	6

ALLOWANCE TO YARD TOPSAIL

(Fig. 10) Calculated upon 24-in. Canvas.

The undermentioned Table of Seams gives the allowances required for the giving out of the sail upon the head and foot, exclusive of Body Seams.

No. of Seams.	Head. Inches.	1st Foot. Inches.	2nd Foot. Inches.
		2⅞ Mast Tabling.	
¾		2	1/16
1		2½	⅛
2		2¾	¼
3		2¼	¼
4	⅛	2⅛	¼
5	¼	2	⅜
6	⅜	1⅞	⅜
7	⅝	1¾	⅜
8	⅞	1⅝	⅜
9	1⅛	1½	⅜
10	1⅜	1⅜	½
11	1⅝	1¼	½
12	1¾	1⅛	½
13	1⅞	1	½
14	2	⅞	½
15	2¼	¾	⅜
16	2⅜	⅝	⅜
17	2½	½	¼
18	2⅝	⅜	⅛
19	2¾	¼	1/16.
20	4½ Leech Tabling		
	29	31	6½

JIB-HEADED TOPSAIL

(Fig. 11) Calculated upon 18-in. Canvas.

This sail will give out upon the foot at the rate of 2 in. per foot of the clew gore, which is 12 ft. 8 in.; therefore it will stretch 25⅓ in. This is taken in by the seams from the tack to clew, less

1½ in., which can be creased in upon the leech tabling. The round of foot should be allowed for by creasing the seams upon it 4 in. per foot of round over the amount of seam upon the line from the tack to clew. Hollow is required to the mast at the rate of a ¼ in. per foot of the line from the square of mast through the centre, as shown upon drawing, which is 25 ft.; therefore the hollow to mast is 6¼ in.

This sail needs 28¾ cloths, reckoning the body seams at 1 in.

The seam allowance for the giving out of the foot is as follows:—

No. of Seams.	1st Foot Seams. Inches.	Foot (Round) Seams. Inches.
1	⅛	0
2	¼	0
3	⅜	⅛
4	½	⅛
5	½	⅛
6	⅝	⅛
7	⅝	⅛
8	¾	¼
9	¾	¼
10	⅞	¼
11	⅞	¼
12	1	⅜
13	1	⅜
14	1⅛	⅜
15	1⅛	⅜
16	1¼	⅜
17	1¼	⅜
18	1⅜	⅜
19	1⅜	¼
20	1⅜	¼
21	1⅜	¼
22	1⅜	¼
23	1⅜	¼
24	1⅛	¼
25	¾	⅛
26	½	⅛
27	¼	0
28	⅛	0
29	1½ Leech Tabling	
	25½	6

BARGE'S TOPSAIL

(Fig. 12) Calculated upon 24-in. Canvas.

The allowances for this sail are similar to those previously described. The hollow to the mast should be rubbed in from the throat to the lower hole at mast head, and from thence to the tack perfectly straight. Whatever distance the tack is required away from the mast head when spreading the sail, a line should be pulled tight from the head of sail where the slings are to be fixed, carrying it down to the line of the tack, touching at the lower hole upon the mast of sail. The tack should then be rubbed in the distance needed from the straight line.

For the stretching of the foot the seam allowances are as under :—

No. of Seams.	1st Foot Seams. Inches.	Foot (Round) Seams. Inches.
1	3/8	1/8
2	1/2	1/8
3	5/8	1/8
4	3/4	1/4
5	7/8	1/4
6	1	1/4
7	1 1/8	3/8
8	1 1/4	3/8
9	1 3/8	3/8
10	1 1/2	1/2
11	1 5/8	1/2
12	1 3/4	1/2
13	1 3/4	1/2
14	1 1/2	3/8
15	1 1/4	1/4
16	1	1/8
17	1 3/4 Leech Tabling	
	20	5

LUG SAILS.

There are many different shapes of lug sails, but the two given (Figs. 13 and 14) are sufficient to show the cause of the difference in the allowances needed, which depends entirely upon the centre of gravity and the action of the wind upon the sail to those parts attached to the spars, etc.

BALANCE LUG

(Fig. 13) Calculated upon 12-in. Material.

The above sail is in great demand and very serviceable, being easily worked, and if properly made is a very flat sail. It will be seen from the illustration that the centre of effort (marked by a star) shows the position of strain to be on the mast. The line from mast striking through the centre towards the leech is the square line from mast, being the shortest line from the centre and is the position of the strain.

The head of the sail will give out at the rate of 2 in. per foot of the peek gore; but should the gore be longer upon the leech than the square line from the throat to leech, the allowance should be made upon the length of the square line. For instance, the peek gore measures 6 in. more than the square line, which is 10 ft 9 in., therefore the head will give out 21½ in. This amount should be taken in by the seams upon the head, less 3 in., which may be taken in upon the leech tabling.

The foot, which is laced at the boom, will stretch at the rate of 2 in. per foot of the clew gore, but on account of the position of centre of gravity of the sail, it should be calculated from the line which runs through the centre to the leech, which is 6 ft. 9 in. from the clew, therefore the foot will stretch 13½ in., to be taken in by the seams, less 1½ in., which can be creased in upon the leech tabling at the clew.

The wide seam for the foot should commence upon the line at the tack (*d*) following along towards *c*, until the line leading through the centre is reached, and from thence led down on line of the clew.

The head seams should commence upon the line at throat (*b*) in the direction of *a*. The head requires to be rounded a ¼ in. per foot of the length of yard, if a straight one, but if bent, the amount of round must be added to the allowance already given.

The mast needs to be hollowed a ¼ in. per foot of the square line through the centre, and reduced by length from slings to the line of pressure upon the mast at the same rate. For instance, the length of square line is 13 ft.; subtracting length from line of pressure to slings 6 ft. will leave 7 ft.

A quarter of an inch per foot of 7 ft. is 1¾ in., the amount of hollow required.

The seam allowances for the stretching of sail are as under :—

No. of Seams.	Foot Seams. Inches.	Head Seams. Inches.
1	⅛	
2	¼	
3	½	
4	¾	¼
5	⅞	¾
6	1	1
7	1⅛	1⅛
8	1⅛	1⅜
9	1¼	1⅝
10	1¼	1¾
11	1⅜	1⅞
12	1⅛	2
13	¾	2⅛
14	⅜	2¼
15	⅛	2⅜
16	1½ Leech	3 Leech
	13½	21½

LUG SAIL

(Fig. 14) Calculated upon 12-in. Canvas.

A sail of this cut is undoubtedly the best that has ever been produced, especially for fine-bottom boats, the centre of gravity being lower, according to the size of the sail, than in others of a different shape; therefore there is not so much pressure upon the boat. It will be seen from the illustration that the strain caused by the action of the wind upon the centre is on the head of the sail, and assuming that all strains work upon straight lines, this must be considered and dealt with accordingly.

The centre of gravity of this sail causes a difference in the allowances to those of other sails. For instance, unlike the mainsails shown in Chapter IV., where the line of pressure does not pass through either of the square lines, that upon this lug passes through both. The difference this makes to the stretching of the foot, after allowing it to give out 3 in. per foot of the clew gore, which is 11 ft., is by reducing it 3 ft. 9 in., the length from square line to line of pressure upon the leech, leaving 7 ft. 3 in., or 22 in. the amount of stretch. This must be taken in by the seams, commencing at the tack (*d*) running upon line leading towards *c*, until encountering line leading from line of pressure to the clew, the seams running down inside.

The allowance to the head is arrived at by striking a line from the line of pressure upon the head across the canvas by a thread, and measuring the length of the line; and if the peek gore exceeds in length such line, the allowance must be made upon the length of line across the sail at the rate of 2 in. per foot. For instance, the line across the sail is 13 ft., allowing for the give-out 26 in. In consequence of the position of the threads of the canvas in relation to the strain, a reduction must be made by measuring the distance from the line of pressure upon leech to the upper line across sail, which measures 9 ft. 6 in. Deducting this from the 13 ft. leaves 3 ft. 6 in., or 7 in. as the give-out upon the head.

The head should be rounded at the rate of a ¼ in. per foot of the length of yard.

The mast should be treated as that of lug, already described. The seam allowance is as follows :—

No. of Seams.	Foot Seams. 1st. Inches.	Foot Seams. Round. Inches.	Head Seams. Inches.
1	$\frac{1}{2}$	$\frac{1}{8}$	
2	$\frac{5}{8}$	$\frac{1}{8}$	
3	$\frac{3}{4}$	$\frac{1}{8}$	
4	$\frac{7}{8}$	$\frac{1}{4}$	0
5	1	$\frac{1}{4}$	0
6	$1\frac{1}{8}$	$\frac{3}{8}$	$\frac{1}{8}$
7	$1\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{8}$
8	$1\frac{1}{2}$	$\frac{5}{8}$	$\frac{1}{4}$
9	$1\frac{5}{8}$	$\frac{5}{8}$	$\frac{1}{4}$
10	$1\frac{3}{4}$	$\frac{5}{8}$	$\frac{1}{4}$
11	$1\frac{7}{8}$	$\frac{5}{8}$	$\frac{3}{8}$
12	2	$\frac{1}{2}$	$\frac{3}{8}$
13	$1\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{8}$
14	$1\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$
15	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{2}$
16	$\frac{3}{8}$	$\frac{1}{8}$	$\frac{1}{2}$
17	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{5}{8}$
18	3 Leech		$2\frac{3}{4}$ Leech
	22	$6\frac{1}{8}$	7

CHAPTER VII.

CALCULATION OF GORES.

Best Way of Calculating Gores—Calculation of Gores for Cutter Yacht's Mainsail (Round Foot), Cutter Yacht's Mainsail (Laced Foot), Yawl Yacht's Mainsail, Barge's Sprit Mainsail, Yacht's Stay Foresail, Jib (Ordinary Cut), Jib (Diagonal Cut), Yard Topsail, Jib-Headed Topsail, Barge's Topsail, Balance Lug and Lug Sail.

The calculation of the gores of a sail being a very simple matter to all sailmakers, in this chapter I shall merely make a few suggestions as to the quickest and best way. It is by calculating first the total length of the gore required upon the number of cloths needed for a sail. The eating in by the seams, which are widened to make the allowance for the stretching of the gore, should be calculated separately (*see* Chapter VI. upon Allowances, and Chapter VIII. upon Cutting-out).

It must be understood that there are other calculations needed before starting upon the gores of a sail, which, if not made and considered in their bearing upon the gores will render them faulty, however carefully they may have been calculated (*see* Chapter VI.). The calculation as to what the head will give out, and the amount of slack required in mainsail, etc., must be considered before one can calculate the gores aright.

Having made these calculations, say upon a mainsail, starting with the head gores, take the length of peek gore and reduce by amount of slack calculated for the seams. For instance, the peek gore of mainsail (Fig. 3) is 21 ft.: reduce by amount of slack in seams, which is 4 ft., thus calculating the peek gore for 17 ft., with a round upon the head of a $\frac{1}{4}$ in. per foot of the gaff. The length of the gaff is 47 ft., giving a round of 11$\frac{3}{4}$ in. The foot gores should be got in a similar way, not allowing for slack seams, but only for the stretching of the sail at the clew, which is about 12 in.; thus the calculation of the foot gores must be made to cut down 15 ft. 6 in., after deducting the amount of the gore cut up at the clew, for the formation of a round foot.

The mast gores must be calculated to the full, making no allowance for the eating in of the seams. For treatment of seams, *see* Chapter VI.

All gores should be calculated upon the length of the selvage of gore, and not upon the angle of the canvas. If the gores are calculated aright upon the length of the selvage—such, for instance, as the peek gore, shown upon mainsail (Fig. 3)—the angle of the gore for the length of head cannot fail to be right.

In calculating the gores for a large sail, where a round is required, the most simple and effectual way is to divide the number of cloths needed into two or more parts, which can be done by measuring upon the square line and marking equal proportions—either the middle, thirds or quarters, as desired. Then squaring at those parts, from the line marked upon, getting the length of gore needed at those points, and allowing tablings if required, with the necessary round of head. By this method one can make sure of calculating the exact round required, and in the same form as shown upon paper.

For calculating the gores for the stay of a jib, *see* drawing of jib (ordinary cut) in Chapter V. The length from head (*a*) to the point *c* is the total length the gore required. Add to the length of square line from the sheet to stay at the rate of a $\frac{1}{2}$ in. per foot of tack gore, and subtracting it from the length of the bottom line. The remainder, if divided by the width of canvas used, will give the number of cloths needed below the square line of sheet. The upper gores should vary from this point to cut the length required from the sheet to the head, with what little reduction may be necessary for the stretching of the upper part.

CALCULATION OF THE GORES FOR MAINSAIL

(Fig. 3) Upon 12-in. Canvas.

No. of Cloths.	Foot Gores. Inches.	Mast Gores. Ft.	Mast Gores. In.	Head Gores. Inches.
¾	10	2	0	
1	12	2	7	
2	10	2	7	
3	10	2	6	
4	8	2	5½	
5	8	2	5½	
6	6¾	2	5	
7	6¾	2	5	
8	6¼	2	4½	
9	6¼	2	4½	
10	5¾	2	5	
11	5¾	2	5	
12	5¼	2	5	
13	5¼	2	5	
14	5	2	6	
15	5	2	6	
16	4¾	2	7	
17	4¾	0	10	6
18	4½	42	3	7¾
19	4½	...		7¼
20	4¼	...		7¼
21	4¼	...		7
22	4	...		7
23	4	...		6¾
24	3¾	...		6¾
25	3¾	..		6½
26	3½	...		6½
27	3½	...		6¼
28	3¼	...		6¼
29	3¼	...		6
30	3	...		6
31	3	...		5¾
32	2¾	...		5¾
33	2¾	...		5½
34	2½	...		5½
35	2½	...		5¼
36	2¼	...		5¼
37	2¼	...		5¾
38	2	...		5
39	2	...		4
40	1¾	...		4¾
41	1¾	...		4½
42	1½	...		4¼
43	1½	...		4
44	1¼	...		3¾
45	1	...		3½
46	1	...		3½
47	1	...		3¼
48	¾	...		3¼
49	¾	...		3
50	½	...		3
51	¼	...		2¾
52	0	...		2¾
53	0	...		2¼
54	¼	...		2¼
55	½	...		2
56	¾	...		2
57	1¼	...		1¾
58	1¾	...		1½
59	2½	...		1
60	3¼	...		1
61	4	...		¾
62	4¾	...		½
63	5½	...		¼
	17 5½			16 10½
	2 0½ Cut up			
	15 5			

CALCULATION OF THE GORES FOR MAINSAIL

(Fig. 4) Upon 12-in. Canvas.

No. of Cloths.	Foot Gores. Inches.	Mast Gores. Ft.	Mast Gores. In.	Head Gores. Inches.
¾	4	2	0	
1	4½	2	7	
2	4½	2	7	
3	4½	2	6	
4	4½	2	5½	
5	4¼	2	5½	
6	4¼	2	5	
7	4¼	2	5	
8	4¼	2	4½	
9	4	2	4½	
10	4	2	5	
11	4	2	5	
12	4	2	5	
13	3¾	2	5	
14	3¾	2	6	
15	3¾	2	6	
16	3¾	2	7	
17	3½	⅓ 0	10	⅔ 7
18	3½	42	3	9
19	3½			8
20	3½	...		8
21	3½	...		7¼
22	3½	...		7¼
23	3¼	...		6½
24	3¼	...		6½
25	3¼	...		6¼
26	3¼	...		6¼
27	3¼	...		6
28	3¼	...		6
29	3	...		5¾
30	3	...		5¾
31	3	...		5½
32	3	...		5½
33	2¾	...		5¼
34	2¾	...		5¼
35	2¾	...		5¼
36	2¾	...		5¼
37	2½	...		5
38	2½	...		5
39	2½	...		4¾
40	2½	...		4¾
41	2¼	...		4¾
42	2¼	...		4¾
43	2¼	...		4½
44	2¼	...		4½
45	2¼	...		4½
46	2	...		4½
47	2	...		4¼
48	2	...		4¼
49	2	...		4¼
50	2	...		4¼
51	2	...		4¼
52	2	...		4
53	1¾	...		4
54	1¾	...		4
55	1¾	...		3¾
56	1¾	...		3¾
57	1½	...		3¾
58	1½	...		3¾
59	1½	...		3½
60	1¼	...		3½
61	1¼	...		3½
62	1¼	...		3½
63	1¼	...		3¼
	15 5¼			20 0

CALCULATION OF THE GORES FOR MAINSAIL

(Fig. 5) Upon 12-in. Canvas.

No. of Cloths.	Foot Gores. Inches.	Mast Gores. Ft.	Mast Gores. In.	Head Gores. Inches.
⅔	4¼	2	2	
1	5½	3	3	
2	5	3	3	
3	4¾	3	2	
4	4¾	3	1½	
5	4½	3	0½	
6	4¼	3	0½	
7	4¼	3	0½	
8	4¼	3	0½	
9	4	3	1½	
10	4	3	1½	
11	3¾	3	2½	
12	3¾	3	2½	
13	3½	3	2½	
14	3½	43	0	11
15	3¼	...		10
16	3¼	...		9
17	3¼	...		8
18	3¼	...		8
19	3	...		7¾
20	3	...		7¾
21	3	...		7½
22	3	...		7½
23	2¾	...		7¼
24	2¾	...		7¼
25	2½	...		7
26	2½	...		7
27	2¼	...		6¾
28	2¼	...		6¾
29	2	...		6½
30	2	...		6½
31	1¾	...		6¼
32	1½	...		6¼
33	1½	...		6
34	1¼	...		6
35	1¼	...		5¾
36	1	...		5¾
37	1	...		5½
38	¾	...		5½
39	¾	...		5¼
40	½	...		5¼
41	½	...		5
42	¼	...		5
43	0	...		4¾
44	¼	...		4¾
45	½	...		4½
46	¾	...		4½
47	1¼	...		4¼
48	1¾	...		4¼
49	2¼	...		4
50	2¾	...		4
51	3¼	...		3½
52	3¾	...		3
53	4½	...		2½
	10 0			20 3
	1 9 Cut up			
	8 3			

CALCULATION OF THE GORES FOR MAINSAIL

(FIG. 3) UPON 18-IN. CANVAS.

No. of Cloths.	Foot Gores. Ft.	In.	Mast Gores. Ft.	In.	Head Gores. Ft.	In.
1	1	6	3	10		
2	1	4	3	10		
3	1	2	3	9		
4	1	1	3	9		
5	1	0	3	8		
6	0	11	3	8		
7	0	10½	3	8		
8	0	10	3	8		
9	0	9½	3	9		
10	0	9	3	9		
11	0	8½	3	10		
12	0	8	1	11½	0	8
13	0	7½	43	1	1	3
14	0	7			1	2
15	0	6½			1	1
16	0	6			1	0
17	0	5½			0	11
18	0	5			0	10
19	0	4½			0	9½
20	0	4			0	9
21	0	3½			0	8½
22	0	3¼			0	8
23	0	3			0	7½
24	0	2¾			0	7
25	0	2½			0	6½
26	0	2¼			0	6
27	0	2			0	6
28	0	1¾			0	5½
29	0	1½			0	5½
30	0	1¼			0	5
31	0	1			0	5
32	0	¾			0	4½
33	0	½			0	4½
34	0	¼			0	4
35	0	0			0	4
36	0	¼			0	3
37	0	½			0	3
38	0	1			0	3
39	0	2			0	2½
40	0	4			0	2½
41	0	7			0	2
42	0	10			0	2
	17	7¾			17	3
	2	0¾ Cut up				
	15	7				

CALCULATION OF THE GORES FOR MAINSAIL

(Fig. 4) Upon 18-in. Canvas.

No. of Cloths.	Foot Gores. Inches.	Mast Gores. Ft.	Mast Gores. In.	Head Gores. Ft.	Head Gores. In.
1	6¼	3	10		
2	6¼	3	10		
3	6¼	3	9		
4	6¼	3	9		
5	6	3	8		
6	6	3	8		
7	6	3	8		
8	6	3	8		
9	5¾	3	9		
10	5¾	3	9		
11	5¾	3	10		
12	5¾	1	11½	0	9
13	5½	43	1	1	4½
14	5½	...		1	3½
15	5¼	...		1	2½
16	5¼	...		1	1½
17	5	...		1	0½
18	5	...		0	11½
19	4¾	...		0	11
20	4¾	...		0	10½
21	4½	...		0	10
22	4½	–		0	9½
23	4¼	...		0	9
24	4¼	...		0	8
25	4	...		0	8
26	4	...		0	7½
27	3¾	...		0	7½
28	3¾	...		0	7
29	3½	...		0	7
30	3½	...		0	6½
31	3¼	...		0	6½
32	3¼	...		0	6
33	3	...		0	6
34	3	...		0	5½
35	2¾	...		0	5½
36	2¾	...		0	5
37	2½	...		0	4½
38	2½	...		0	4½
39	2½	...		0	4
40	2¼	...		0	4
41	2¼	...		0	3½
42	2¼	...		0	3½
	15 5¾			21	1

CALCULATION OF THE GORES FOR MAINSAIL (FIG. 5) UPON 18-IN. CANVAS.

No. of Cloths.	Foot Gores. Inches.		Mast Gores. Ft.	Mast Gores. In.		Head Gores. Ft.	Head Gores. In.
1	11		4	10			
2	9		4	10			
3	8		4	8			
4	7		4	6			
5	6½		4	4			
6	6		4	4			
7	6		4	6			
8	5½		4	8			
9	5½		4	10			
10	5	⅓	1	8	⅔	1	0
11	5		43	1		1	6
12	4½		...	...		1	4
13	4¼		...	...		1	3
14	4		...	...		1	2
15	3¾		...	...		1	1
16	3½		...	...		1	0
17	3¼		...	...		0	11
18	3		...	...		0	10
19	2¾		...	...		0	9½
20	2½		...	...		0	9
21	2¼		...	...		0	8½
22	2		...	...		0	8½
23	1¾		...	...		0	8
24	1½		...	...		0	8
25	1¼		...	...		0	8
26	1		...	...		0	8
27	¾		...	...		0	7½
28	½		...	...		0	7½
29	0		...	...		0	7
30	¼		...	...		0	7
31	½		...	...		0	6½
32	1		...	...		0	6½
33	2¼		...	...		0	6
34	4¼		...	...		0	5½
35	6½		...	...		0	5
	9 9					20	8
	1 2¾ Cut up						
	8 6¼						

CALCULATION OF GORES FOR BARGE'S SPRIT MAINSAIL (FIG. 6).

No. of Cloths.	Foot Gores. Inches.	Mast Gores. Ft.	Mast Gores. In.		Head Gores. Ft.	Head Gores. In.
¾	5	8	9			
1	5½	11	8			
2	5	5	10	½		11
3	4½	26	3		1	10½
4	4	...	...		1	10½
5	3½	...	...		1	9
6	3	...	...		1	9
7	2½	...	...		1	8
8	2	...	...		1	8
9	1½	...	...		1	7
10	1	...	...		1	7
11	½	...	...		1	6
12	0	...	...		1	6
13	½	...	...		1	4½
14	1½	...	...		1	4½
15	3	...	...		1	3
16	5	...	...		1	3
	38				22	11
	10 Cut up					
	28					

CALCULATION OF THE GORES FOR STAY FORESAIL

(FIG. 7) UPON 12-IN. CANVAS.

No. of Cloths.	Foot Gores. Inches.	Stay Gores. Ft.	Stay Gores. In.
1	3½	1	1½
2	3¼	1	1½
3	3⅛	1	1¼
4	3	1	1¼
5	2¾	1	1
6	2½	1	1
7	2⅜	1	0¾
8	2¼	1	0¾
9	2⅛	1	0½
10	2	1	0½
11	1⅞	1	0¼
12	1¾	1	0¼
13	1¾	1	0
14	1⅝	1	0
15	1⅝	1	0
16	1½	1	0
17	1⅜	1	0
18	1¼	1	0
19	1⅛	1	0
20	1	1	0
21	⅞	1	0
22	⅞	1	0
23	¾	1	0
24	⅝	1	0
25	⅝	1	0
26	½	1	0
27	½	1	0
28	⅜	1	0
29	¼	1	0
30	⅛	1	0
31	0	1	0
32	0	1	0¼
33	¼	1	0¼
34	¼	1	0½
35	½	1	0½
36	¾	1	0¾
37	1	1	0¾
38	1¼	1	1
39	1½	1	1
40	1¾	1	1¼
41	2	1	1¼
42	2¼	1	1½
43	2¾	1	1½
	3 10¾	44	9
	1 2 Cut up		
	2 8¾		

CALCULATION OF THE GORES FOR JIB

(FIG. 8) UPON 18-IN. CANVAS.

No. of Cloths.	Foot Gores.		Stay Gores.	
	Ft.	In.	Ft.	In.
1		1	3	3
2		2	3	3
3		2	3	2
4		3	3	2
5		3	3	1
6		4	3	1
7		4	3	1
8		5	3	0½
9		6	3	0½
10		7	3	0
11		8	3	0
12		8	2	11½
13		9	2	11½
14		9	2	11
15		10	2	11
16		11	2	10½
17	1	0	2	10½
18	1	1	2	10
19	1	2	2	10
20	1	3	2	9½
21	1	4	2	9
22	1	5	2	8½
23	1	6	2	8
24	1	7	2	7½
25	1	9	2	7
26	2	0	2	6
	21	9	75	10½

CALCULATION OF THE GORES FOR STAY FORESAIL

(Fig. 7) Upon 18-in. Canvas.

No. of Cloths.	Foot Gores. Inches.	Stay Gores. Ft.	In.
⅔	3	1	3
1	4	1	10
2	3¾	1	9½
3	3½	1	9
4	3¼	1	8½
5	3	1	8
6	2¾	1	7½
7	2½	1	7
8	2¼	1	6½
9	2¼	1	6
10	2	1	6
11	2	1	6
12	1¾	1	6
13	1¾	1	6
14	1½	1	6
15	1½	1	6½
16	1¼	1	6½
17	1	1	6½
18	1	1	6½
19	¾	1	7
20	½	1	7
21	0	1	7½
22	½	1	7½
23	1	1	8
24	1¾	1	8
25	2½	1	8½
26	3½	1	8½
27	4¾	1	8
	3 9¼	44	9
	1 2 Cut up		
	2 7¼		

CALCULATION OF THE GORES FOR JIB

(Fig. 8) Upon 24-in. Canvas.

No. of Cloths.	Foot Gores.		Stay Gores.	
	Ft.	In.	Ft.	In.
½		2	2	4
1		4	4	8
2		5	4	7
3		6	4	6
4		7	4	5
5		8	4	4
6		9	4	4
7		10	4	2
8		11	4	0
9	1	0	3	10
10	1	1	3	9
11	1	2	3	8
12	1	3	3	7
13	1	4	3	6
14	1	5	3	5
15	1	6	3	4
16	1	8	3	4
17	1	10	3	8
18	2	1	3	3
19	2	4	3	2
	21	10	75	5

CALCULATION OF THE GORES FOR DIAGONAL JIB

(FIG. 9) UPON 24-IN. CANVAS.

No. of Cloths.	Stay Gores. (Upper part). Ft.	In.	Foot Gores. Inches.	Stay Gores (Lower part). Ft.	In.
¾	3	1	8½	2	3½
1	4	1	11½	2	0½
2	4	0	11½	2	11½
3	3	11	11½	2	10½
4	3	10	11½	2	9½
5	3	9	11½	2	7½
6	3	8	11½	2	6½
7	3	7	11½	2	5½
8	3	6	11½	2	4½
9	3	5	11½	2	3½
10	3	4	11½	2	2½
11	3	3	11½	2	1½
	43	5	11 3	30	7

CALCULATION OF THE GORES FOR DIAGONAL JIB

(FIG. 9) UPON 18-IN. CANVAS.

No. of Cloths.	Stay Gores (Upper part). Ft.	In.	Foot Gores. Inches.	Stay Gores (Lower part). Ft.	In.
⅓	1	0	3		8
1	3	0	9	2	0
2	3	0	9	2	0
3	2	11	9	2	0½
4	2	11	9	2	0½
5	2	10½	9	2	1
6	2	10½	9	2	1
7	2	10	9	2	1½
8	2	10	9	2	1½
9	2	9½	9	2	2
10	2	9½	9	2	2
11	2	9	9	2	2½
12	2	9	9	2	2½
13	2	8	9	2	3
14	2	7	9	2	3
15	2	6	9	0	0
	43	1	11 6	30	5

CALCULATION OF THE GORES FOR YARD TOPSAIL

(Fig. 10) Upon 18-in. Canvas.

No. of Cloths.	Foot Gores.	Mast Gores.		Head Gores.	
	Inches.	Ft.	In.	Ft.	In.
1	4½	4	4		
2	5	4	4		
3	5	4	4		
4	5½	4	4		
5	5½	4	4		
6	6 ⅓	1	6 ⅔	1	4
7	6	23	2	1	10½
8	6			1	10½
9	6			1	9½
10	6			1	9½
11	6			1	9
12	6			1	9
13	6			1	8½
14	6			1	8½
15	6			1	8
16	6			1	8
17	6½			1	7½
18	6½			1	7½
19	7			1	7
20	7			1	7
21	7½			1	6½
22	7½			1	6½
23	8			1	6
24	8			1	6
25	8½			1	5½
26	8½			1	5½
27	9			1	5
28	10			1	5
	15 6			37	2

CALCULATION OF THE GORES FOR YARD TOPSAIL

(Fig. 10) Upon 24-in. Canvas.

No. of Clothe.	Foot Gores.		Mast Gores.			Head Gores.	
	Ft.	In.	Ft.	In.		Ft.	In.
¾		3	5	5			
1		4	7	1			
2		5	7	1			
3		5	3	11	½		11
4		5½	23	4		2	10
5		6				2	9
6		6½				2	8
7		7				2	7
8		8				2	6
9		9				2	5
10		9½				2	4
11		10				2	3
12		10½				2	2
13		11				2	1
14		11½				2	0
15	1	0				1	10½
16	1	0½				1	9
17	1	1				1	7½
18	1	2				1	6
19	1	4				1	4
20	1	6				1	2
	15	6				36	9

CALCULATION OF THE GORES FOR JIB-HEADED TOPSAIL (FIG. 11) UPON 24-IN. CANVAS.

No. of Cloths.	Foot Gores.		Mast Gores.
	Ft.	In.	Inches.
¼		4	3
1	1	3	12
2	1	1	12
3		11	11½
4		10	11½
5		9	11
6		9	11
7		8	10½
8		8	10½
9		7	10½
10		7	10½
11		6	10
12		6	10
13		5	10½
14		5	10½
15		4	10½
16		4	10½
17		3½	11
18		3	11
19		2½	11½
20		2	11½
21		1	12
	11	10	19 5

CALCULATION OF THE GORES FOR JIB-HEADED TOPSAIL (FIG. 11) UPON 18-IN. CANVAS.

No. of Cloths.	Foot Gores. Inches.	Mast Gores. Inches.
¾	8	6½
1	9	9
2	8	9
3	7	8½
4	6½	8½
5	6½	8½
6	6	8
7	6	8
8	5½	8
9	5½	8
10	5¼	7½
11	5¼	7½
12	5	7
13	5	7
14	4¾	7
15	4¾	7
16	4½	7
17	4½	7
18	4¼	7½
19	4¼	7½
20	4	8
21	4	8
22	3¾	8
23	3¾	8½
24	3½	8½
25	3½	8½
26	3¼	8½
27	3¼	8
28	3	8
	12 3½	19

CALCULATION OF THE GORES FOR BARGE'S TOPSAIL

(FIG. 12) UPON 24-IN. MATERIAL.

No. of Cloths.	Foot Gores.		Mast Gores.		Head Gores.
	Ft.	In.	Ft.	In.	Inches.
1	1	3	1	3	
2	1	1	1	2½	
3		11	1	2½	
4		10	1	2	
5		9	1	2	
6		8	1	1½	
7		7	1	1½	
8		7	1	1½	
9		6	1	2	
10		6	1	2	
11		5	1	2½	
12		5	1	3	
13		4	½	10	2½
14		4	15	0	5
15		3			5
16		3			5
17		2			5
	9	10			22½

CALCULATION OF THE GORES FOR BALANCE LUG.

(FIG. 13) UPON 12-IN. MATERIAL.

No. of Cloths.	Foot Gores.		Mast Gores.		Head Gores.	
	Inches.		Ft.	In.	Ft.	In.
1		7¾	1	8		
2		7¾	1	6		
3		7½	1	6		
4		7¼	1	8		
5		7	6	4	1	4
6		6¾			1	3
7		6½			1	2
8		6¼			1	1
9		6			1	0
10		5¾				11
11		5¾				10
12		5½				10
13		5¼				10
14		5				9
15		5				8
16		5				7
	8	4			11	3

CALCULATION OF THE GORES FOR LUG

(Fig. 14).

No. of Cloths.	Foot Gores.	Mast Gores.		Head Gores.	
	Inches.	Ft.	In.	Ft.	In.
½	7		9		
1	12	1	6		
2	11	1	6		
3	10	1	8		
4	9½	5	5	1	5
5	9			1	4
6	8½			1	3
7	8			1	2
8	7½			1	1
9	7			1	0
10	6½			1	0
11	6				11
12	6½				11
13	5				10
14	5½				10
15	4				9
16	3½				9
17	3				8
18	2½				8
	10 10			14	8

CHAPTER VIII.

ON CUTTING OUT.

WHERE TO COMMENCE TO CUT OUT A MAINSAIL—DRAWING SHOWING A METHOD OF MARKING GORES—FIGURES FOR CUTTING OUT CUTTER YACHT'S MAINSAIL (ROUND FOOT), CUTTER YACHT'S MAINSAIL (LACED FOOT), YAWL YACHT'S MAINSAIL, BARGE'S SPRIT MAINSAIL, YACHT'S STAY FORESAIL, JIB (ORDINARY CUT), JIB (DIAGONAL-CUT), YARD TOPSAIL, JIB-HEADED TOPSAIL, BARGE'S TOPSAIL, BALANCE LUG AND LUG SAIL.

THE mode of cutting out sails differs, as may be supposed, with different makers. Some cut from the leech, to enable them to use up the remnants of canvas upon the short cloths without lasting the same.

The best way to cut out a mainsail is to commence at the throat seam, or first head cloth, which can be done by measuring down from the throat line (*d*) to foot (*o*), and getting the exact length. By so doing the remnants of the bolts are left for the mast cloths and linings.

It is taken for granted that everything necessary has been done to produce a flat and lifting sail, such as testing selvages, calculating the gores, slacks and allowances required for the stretching of the gores. As just stated, it is best to commence at the throat seam, having the head and foot gores, and the width of each seam plainly marked in line of the number of each cloth. It is best to calculate the peek and clew gores to just the length required, and not at the same time trouble about eating-in of seams.

As the creasing in of the wide seams of head and foot shortens the length of the long edge or gore, it is advisable to mark upon the cloth the width of the seam wanted, from the calculation of the allowance necessary for the giving out of the gores. For instance, if the head gore needs to be 14 in., strike across the thread and measure 14 in. up the selvage, from the thread struck, and mark the same; then measure in from the selvage the width of seam required for that particular head cloth upon the thread of the canvas; and when marking the gore from one selvage to the other, lay spline or yard stick upon the mark of the near selvage to the inner part of the seam-mark upon off selvage, marking thereto and cutting the same.

By such a method every seam is allowed the exact amount of its eating-in as the cloths are cut out (*see* illustrations to this Chapter, Figs. 16, 17).

After cutting out sail to the leech, the mast should then be cut in a similar manner, allowing the foot seams upon the gore and the body seam upon the mast gore.

It is a good plan, should there be room, to cut the mast of sail out upon the floor, as it will save time in striking the various remnants up one after the other, as they can then be pulled along the floor. It can then be seen what cloths they will best cut to advantage. If this plan is adopted the first head cloth must be spread down, marking up from the foot to the square line at the relative position of the sail.

Mark upon the line the length as shown in the illustration from square line to the tack (*c* to *g*). The hollow to the mast can then be marked and the sail cut thereto.

If these directions are carefully carried out a good sail will be produced, for it is possible to cut a sail of 1,000 yards if the calculations are true, and only be a few inches out; and if the threads are exactly square it will not be out at all.

Fig. 16.

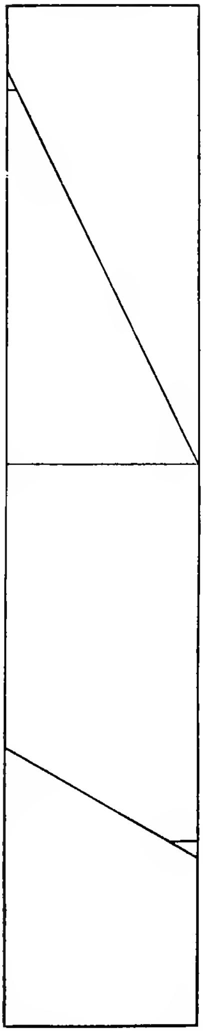
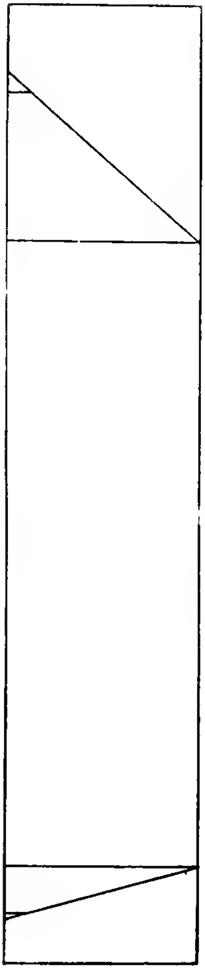


Fig. 17.



Drawings on ½ in. scale, showing method of treating seam allowance when cutting out cloths so as to cut amount of the length of gore which will be reduced by seam when creased.

There are several important points to be observed in producing fore and aft sails, although not bearing upon cutting out, but they need to be borne in mind when the sail is cut out. As the cloths are cut they should be struck together and marked up, and the foot seam marked at its width. It is necessary this should be done to know if any of the cloths have shrunk, as they often do in damp weather. After this is done the head should be spread, and the square line marked from the throat to leech across the threads, which is the seam-mark for commencing the wide seam for the giving out of the head gore.

The foot must also be marked from the tack to leech upon the square line across by the thread, also from the tack to clew.

It is also necessary to mark the angle line from the throat to clew, and if possible to spread the sail and mark from the lower square line upon the leech to the centre of the sail, for the slack of seams, in a similar manner, as shown upon mainsail, giving the method of finding the centre of effort.

DIMENSIONS FOR CUTTING OUT MAINSAIL

(FIG. 3) CALCULATED UPON 12-IN. CANVAS.

No. of Cloths.	Foot Gores.	Mast Gores.		Head Gores.	Foot Seams.	Head Seams.	Slack Seams.
	In.	Ft.	In.	In.	In.	In.	In.
¾	10	2	0		1⅜		
1	12	2	7		1⅜		
2	10	2	7		1½		
3	10	2	6		1½		
4	8	2	5½		1⅝		
5	8	2	5½		1⅝		
6	6¾	2	5		1¾		
7	6¾	2	5		1¾		
8	6¼	2	4½		1⅞		
9	6¼	2	4½		1⅞		
10	5¾	2	5		2		
11	5¾	2	5		2		
12	5¼	2	5		2		
13	5¼	2	5		2		
14	5	2	6		2		
15	5	2	6		2		
16	4¾	2	7		2¼		
17	4¾		10	6	2¼	1 3/16	
18	4½	42	3	7¾	2¼	1¼	
19	4½			7¼	2¼	1⅜	
20	4¼			7¼	2⅜	1⅜	
21	4¼			7	2⅜	1⅜	
22	4			7	2⅜	1⅜	
23	4			6¾	2⅜	1½	
24	3¾			6¾	2⅝	1½	
25	3¾			6½	2⅝	1½	
26	3½			6½	2⅝	1½	
27	3½			6¼	2⅝	1½	
28	3¼			6¼	2¾	1½	
29	3¼			6	2¾	1⅝	
30	3			6	2⅞	1⅝	
31	3			5¾	2⅞	1⅝	
32	2¾			5¾	2⅞	1⅝	
33	2¾			5½	2⅞	1⅝	
34	2½			5½	3	1⅝	
35	2½			5¼	3	1⅝	
36	2¼			5¼	3	1⅝	
37	2¼			5	3	1¾	
38	2			5	3	1¾	
39	2			4¾	3⅛	1¾	⅜
40	1¾			4¾	3⅛	1¾	⅜
41	1¾			4½	3⅛	1¾	½
42	1½			4¼	3⅛	1¾	⅝
43	1½			4	3⅛	1⅞	¾
44	1¼			3¾	3⅛	1⅞	⅞
45	1¼			3½	3⅛	1⅞	1
46	1			3½	3¼	1⅞	1⅛
47	1			3¼	3¼	1⅞	1¼
48	¾			3¼	3¼	1⅞	1⅜
49	¾			3	3⅛	2	1½
50	½			3	3	2	1⅝
51	¼			2¾	2¾	2	1¾
52	0			2¾	2⅝	2	2
53	0			2¼	2½	2⅛	2⅛
54	¼			2¼	2½	2⅛	2½
55	½			2	2⅜	2⅛	2¾
56	¾			2	2¼	2⅛	2¾
57	1¼			1¾	2	2¼	3
58	1¾			1½	1⅞	2¼	3
59	2½			1	1¾	2¼	3¼
60	3¼			1	1⅝	2⅜	3¼
61	4			¾	1⅜	2⅜	3¼
62	4¾			½	1⅜	2 7/16	3½
63	5½			¼			3½
	17 5½			16 10½			48
	2 0½ Cut up						
	15 5						

DIMENSIONS FOR CUTTING OUT MAINSAIL

(Fig. 3) Calculated upon 18-in. Canvas.

No. of Cloths.	Foot Gores. Ft.	Foot Gores. In.	Mast Gores. Ft.	Mast Gores. In.	Head Gores. Ft.	Head Gores. In.	Foot Seams. In.	Head Seams. In.	Slack Seams. In.
1	1	6	3	10			1⅝		
2	1	4	3	10			2		
3	1	2	3	9			2¼		
4	1	1	3	9			2½		
5	1	0	3	8			2¾		
6		11	3	8			2⅞		
7		10½	3	8			2⅞		
8		10	3	8			3		
9		9½	3	9			3⅛		
10		9	3	9			3¼		
11		8½	3	10			3¼		
12		8	1	11	½	8	3⅜	1⅜	
13		7½	43	1	1	3	3⅜	1½	
14		7			1	2	3½	1½	
15		6½			1	1	3½	1⅝	
16		6			1	0	3¾	1⅝	
17		5½				11	3¾	1¾	
18		5				10	3⅞	1¾	
19		4½				9½	3⅞	1⅞	
20		4				9	4	1⅞	
21		3½				8½	4	2	
22		3¼				8	4⅛	2	
23		3				7½	4⅛	2⅛	
24		2¾				7	4	2⅛	
25		2½				6½	4⅛	2¼	
26		2¼				6	4⅛	2¼	¾
27		2				6	4⅛	2⅜	1
28		1¾				5½	4⅛	2⅜	1¼
29		1½				5½	4⅛	2⅜	1½
30		1¼				5	4¼	2½	1¾
31		1				5	4⅛	2½	2
32		¾				4½	3⅞	2⅝	2¼
33		½				4½	3½	2⅝	2½
34		¼				4	3	2¾	2¾
35		0				4	2¾	2¾	3
36		¼				3½	2⅝	2⅞	3¼
37		½				3	2⅜	2⅞	3½
38		1				3	2⅛	3	3¾
39		2				2½	1⅞	3	4¼
40		4				2½	1⅝	3⅛	4½
41		7				2	1½	3⅛	5
42		10				2			5
	17	7¾			17	3			48
	2	0¾ Cut up							
	15	7							

DIMENSIONS FOR CUTTING OUT MAINSAIL

(FIG. 4) CALCULATED UPON 12-IN. CANVAS.

No. of Cloths.	Foot Gores. In.	Mast Gores. Ft.	Mast Gores. In.	Head Gores. In.	Foot Seams. In.	Head Seams. In.
¾	4	2	0		1 3/16	
1	4½	2	7		1 3/16	
2	4½	2	7		1¼	
3	4½	2	6		1¼	
4	4½	2	5½		1⅜	
5	4¼	2	5½		1⅜	
6	4¼	2	5		1⅜	
7	4¼	2	5		1⅜	
8	4¼	2	4½		1⅜	
9	4	2	4½		1⅜	
10	4	2	5		1⅜	
11	4	2	5		1⅜	
12	4	2	5		1⅜	
13	3¾	2	5		1½	
14	3¾	2	6		1½	
15	3¾	2	6		1½	
16	3¾	2	7		1½	
17	3½	⅓	10	⅔ 7	1½	1¼
18	3½	42	3	9	1½	1⅜
19	3½			8	1½	1⅜
20	3½			8	1½	1½
21	3½			7¼	1½	1½
22	3¼			7¼	1½	1½
23	3¼			6½	1⅝	1½
24	3¼			6½	1⅝	1⅝
25	3¼			6¼	1⅝	1⅝
26	3¼			6¼	1⅝	1⅝
27	3¼			6	1⅝	1⅝
28	3¼			6	1⅝	1¾
29	3			5¾	1⅝	1¾
30	3			5¾	1⅝	1¾
31	3			5½	1⅝	1¾
32	3			5½	1⅝	1⅞
33	2¾			5¼	1¾	1⅞
34	2¾			5¼	1¾	1⅞
35	2¾			5¼	1¾	1⅞
36	2¾			5¼	1¾	1⅞
37	2½			5	1⅞	2
38	2½			5	1⅞	2
39	2½			4¾	1⅞	2
40	2½			4¾	1⅞	2
41	2¼			4¾	1⅞	2
42	2¼			4¾	1⅞	2⅛
43	2¼			4½	2	2⅛
44	2¼			4½	2	2⅛
45	2¼			4½	2	2⅛
46	2			4½	2	2⅛
47	2			4¼	2	2⅛
48	2			4¼	2	2⅛
49	2			4¼	1⅞	2¼
50	2			4¼	1⅞	2¼
51	2			4¼	1¾	2¼
52	2			4	1¾	2¼
53	1¾			4	1⅝	2¼
54	1¾			4	1⅝	2⅜
55	1¾			3¾	1½	2⅜
56	1¾			3¾	1½	2⅜
57	1½			3¾	1⅜	2⅜
58	1½			3¾	1⅜	2⅜
59	1½			3½	1¼	2½
60	1¼			3½	1¼	2½
61	1¼			3½	1 3/16	2½
62	1¼			3½	1 3/16	2½
63	1¼			3¼		
15	5¼			20		

DIMENSIONS FOR CUTTING OUT MAINSAIL

(FIG. 4) CALCULATED UPON 18-IN. CANVAS.

No. of Cloths.	Foot Gores. Inches.	Mast Gores. Ft. In.	Head Gores. Ft. In.	Foot Seams. Inches.	Head Seams. Inches.
1	6¼	3 10		1⅜	
2	6¼	3 10		1½	
3	6¼	3 9		1½	
4	6¼	3 9		1⅝	
5	6	3 8		1⅝	
6	6	3 8		1⅝	
7	6	3 8		1⅝	
8	6	3 8		1¾	
9	5¾	3 9		1¾	
10	5¾	3 9		1¾	
11	5¾	3 10		1¾	
12	5¾	1 11½	9	1⅞	1⅜
13	5½	43 1	1 4½	1⅞	1½
14	5½		1 3½	1⅞	1⅝
15	5¼		1 2½	2	1¾
16	5¼		1 1½	2	1⅞
17	5		1 0½	2	1⅞
18	5		11½	2	2
19	4¾		11	2⅛	2
20	4¾		10½	2⅛	2⅛
21	4½		10	2¼	2⅛
22	4½		9½	2¼	2¼
23	4¼		9	2¼	2¼
24	4¼		8½	2¼	2⅜
25	4		8	2¼	2⅜
26	4		7½	2¼	2½
27	3¾		7½	2¼	2½
28	3¾		7	2⅜	2⅝
29	3½		7	2⅜	2⅝
30	3½		6½	2⅜	2¾
31	3¼		6½	2⅜	2⅞
32	3¼		6	2⅜	2⅞
33	3		6	2⅜	3
34	3		5½	2¼	3
35	2¾		5½	2⅛	3⅛
36	2¾		5	2	3⅛
37	2½		4½	1⅞	3¼
38	2½		4½	1¾	3¼
39	2½		4	1⅝	3⅜
40	2¼		4	1½	3½
41	2¼		3½	1⅜	3⅝
42	2¼		3½		
	15 5¼		21 1		

DIMENSIONS FOR CUTTING OUT MAINSAIL

(FIG. 5) CALCULATED UPON 18-IN. CANVAS.

No. of Cloths.	Foot Gores.	Mast Gores.		Head Gores.		Foot Seams.	Head Seams.	Slack Seams.
	Inches.	Ft.	In.	Ft.	In.	Inches.	Inches.	Inches.
1	11	4	10			1½		
2	9	4	9			1¾		
3	8	4	8			2		
4	7	4	6			2		
5	6½	4	4			2		
6	6	4	4			2¼		
7	6	4	6			2¼		
8	5½	4	8			2¼		
9	5½	4	10			2⅜		
10	5 ⅓	1	8 ⅔	1	0	2½	1⅜	
11	5	43	1	1	6	2⅝	2	
12	4½			1	4	2¾	2⅛	
13	4¼			1	3	2⅞	2¼	
14	4			1	2	2⅞	2¼	
15	3¾			1	1	3	2⅜	
16	3½			1	0	3	2⅜	
17	3¼				11	3⅛	2½	
18	3				10	3¼	2½	
19	2¾				9½	3⅜	2½	
20	2½				9	3½	2⅝	
21	2¼				8½	3½	2⅝	
22	2				8½	3½	2¾	⅜
23	1¾				8½	3⅜	2¾	1⅛
24	1½				8½	3¼	2¾	1¼
25	1¼				8	3¼	2⅞	1¾
26	1				8	3⅜	2⅞	1½
27	¾				7½	3¼	3	2
28	½				7½	3¼	3	2
29	0				7	2⅞	3⅛	2
30	¼				7	2⅞	3⅛	2⅛
31	½				6½	2½	3¼	2¼
32	1				6½	2¼	3¼	2½
33	2¼				6	2	3⅜	2⅝
34	4¼				5½	1¾	3⅜	3
35	6½				5			3
	9 9			20	8			27½
	1 2¾	Cut up						
	8 6¼							

DIMENSIONS FOR CUTTING OUT MAINSAIL (FIG. 5) CALCULATED UPON 12-IN. CANVAS.

No. of Cloths.	Foot Gores. Inches.	Mast Gores. Ft.	Mast Gores. In.	Head Gores. Inches.	Foot Seams. Inches.	Head Seams. Inches.	Slack Seams. Inches.
⅔	4¼	2	2		1 5/16		
1	5½	3	3		1½		
2	5	3	3		1½		
3	4¾	3	2		1⅝		
4	4¾	3	1½		1¾		
5	4½	3	0½		1¾		
6	4¼	3	0½		1¾		
7	4¼	3	0½		1⅞		
8	4¼	3	0½		1⅞		
9	4	3	1½		1⅞		
10	4	3	1½		2		
11	3¾	3	2½		2		
12	3¾	3	2½		2		
13	3½	3	2½		2		
14	3½	43	0	11	2⅛	1¼	
15	3¼			10	2⅛	1¼	
16	3¼			9	2⅛	1⅜	
17	3¼			8	2¼	1⅜	
18	3¼			8	2¼	1⅜	
19	3			7¾	2¼	1½	
20	3			7¾	2¼	1½	
21	3			7½	2¼	1½	
22	3			7½	2¼	1⅝	
23	2¾			7¼	2¼	1⅝	
24	2¾			7¼	2¼	1⅝	
25	2½			7	2⅜	1¾	
26	2½			7	2⅜	1¾	
27	2¼			6¾	2⅜	1¾	
28	2¼			6¾	2⅜	1⅞	
29	2			6½	2⅜	1⅞	
30	2			6½	2⅜	1⅞	
31	1¾			6¼	2½	2	
32	1½			6¼	2⅜	2	
33	1½			6	2⅜	2	
34	1¼			6	2⅜	2⅛	¼
35	1¼			5¾	2⅜	2⅛	⅜
36	1			5¾	2⅜	2¼	½
37	1			5½	2⅜	2¼	⅝
38	¾			5½	2½	2¼	¾
39	¾			5¼	2½	2⅜	⅞
40	½			5¼	2⅜	2⅜	1
41	½			5	2⅜	2½	1⅛
42	¼			5	2⅜	2½	1¼
43	0			4¾	2¼	2½	1⅜
44	¼			4¾	2¼	2½	1½
45	½			4½	2⅛	2½	1⅝
46	¾			4½	2	2⅝	1¾
47	1¼			4¼	1¾	2⅝	1¾
48	1¾			4¼	1⅝	2⅝	1⅞
49	2¼			4	1⅜	2⅝	1⅞
50	2¾			4	1⅜	2¾	2⅛
51	3¼			3½	1⅜	2¾	2⅛
52	3¾			3	1¼	2¾	2½
53	4½			2½			2¾
	10 0			20 3			27
	1 9 Cut up						
	8 3						

DIMENSIONS FOR CUTTING OUT BARGE'S SPRIT MAINSAIL

(FIG. 6) CALCULATED UPON 24-IN. CANVAS.

No. of Cloths.	Foot Gores.	Mast Gores.		Head Gores.		Foot Seams.	Head Seams.	Slack Seame.
	Inches.	Ft.	In.	Ft.	In.	Inches.	Inches.	Inches.
¾	5	8	9			1⅜		
1	5½	11	8			1⅝		
2	5 ½	5	10		11	1⅞	2½	
3	4½	26	3	1	10½	2⅛	3¼	
4	4			1	10½	2¼	3½	
5	3½			1	9	2½	3¾	
6	3			1	9	2⅝	4	
7	2½			1	8	2⅞	4¼	
8	2			1	8	2⅞	4⅜	
9	1½			1	7	3	4½	
10	1			1	7	3	4⅝	¼
11	½			1	6	3	4¾	½
12	0			1	6	3	4⅞	¾
13	½			1	4½	2⅝	4⅞	1
14	1½			1	4½	2	5	1½
15	3			1	3	1½	5	1¾
16	5			1	3			1¾
	38			22	11			7½
	10 Cut up							
	28							

DIMENSIONS FOR CUTTING OUT STAY FORESAIL

(FIG. 7) CALCULATED UPON 12-IN. CANVAS.

No. of Cloths.	Foot Gores.	Stay Gores.		Foot Seams.	Slack Seams.
	Inches.	Ft.	In.	Inches.	Inches.
1	$3\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{8}$	
2	$3\frac{1}{4}$	1	$1\frac{1}{2}$	$1\frac{3}{16}$	
3	3	1	$1\frac{1}{4}$	$1\frac{3}{16}$	
4	3	1	$1\frac{1}{4}$	$1\frac{1}{4}$	
5	$2\frac{3}{4}$	1	1	$1\frac{1}{4}$	
6	$2\frac{1}{2}$	1	1	$1\frac{5}{16}$	
7	$2\frac{3}{8}$	1	$0\frac{3}{4}$	$1\frac{5}{16}$	
8	$2\frac{1}{4}$	1	$0\frac{3}{4}$	$1\frac{5}{16}$	
9	2	1	$0\frac{1}{2}$	$1\frac{5}{16}$	
10	2	1	$0\frac{1}{2}$	$1\frac{5}{16}$	
11	$1\frac{7}{8}$	1	$0\frac{1}{4}$	$1\frac{3}{8}$	
12	$1\frac{3}{4}$	1	$0\frac{1}{4}$	$1\frac{3}{8}$	
13	$1\frac{3}{4}$	1	0	$1\frac{3}{8}$	
14	$1\frac{5}{8}$	1	0	$1\frac{3}{8}$	
15	$1\frac{5}{8}$	1	0	$1\frac{3}{8}$	
16	$1\frac{1}{2}$	1	0	$1\frac{7}{16}$	
17	$1\frac{3}{8}$	1	0	$1\frac{1}{2}$	
18	$1\frac{1}{4}$	1	0	$1\frac{1}{2}$	
19	1	1	0	$1\frac{1}{2}$	
20	1	1	0	$1\frac{1}{2}$	
21	$\frac{7}{8}$	1	0	$1\frac{1}{2}$	
22	$\frac{3}{4}$	1	0	$1\frac{1}{2}$	
23	$\frac{3}{4}$	1	0	$1\frac{9}{16}$	
24	$\frac{5}{8}$	1	0	$1\frac{9}{16}$	
25	$\frac{5}{8}$	1	0	$1\frac{3}{4}$	
26	$\frac{1}{2}$	1	0	$1\frac{3}{4}$	
27	$\frac{1}{2}$	1	0	$1\frac{3}{4}$	
28	$\frac{3}{8}$	1	0	$1\frac{3}{4}$	
29	$\frac{1}{4}$	1	0	$1\frac{9}{16}$	$\frac{1}{8}$
30	$\frac{1}{8}$	1	0	$1\frac{9}{16}$	$\frac{1}{8}$
31	0	1	0	$1\frac{9}{16}$	$\frac{1}{4}$
32	0	1	$0\frac{1}{4}$	$1\frac{9}{16}$	$\frac{1}{4}$
33	$\frac{1}{4}$	1	$0\frac{1}{4}$	$1\frac{9}{16}$	$\frac{3}{8}$
34	$\frac{1}{4}$	1	$0\frac{1}{2}$	$1\frac{9}{16}$	$\frac{3}{8}$
35	$\frac{1}{2}$	1	$0\frac{1}{2}$	$1\frac{9}{16}$	$\frac{1}{2}$
36	$\frac{1}{2}$	1	$0\frac{3}{4}$	$1\frac{9}{16}$	$\frac{1}{2}$
37	1	1	$0\frac{3}{4}$	$1\frac{1}{2}$	$\frac{5}{8}$
38	$1\frac{1}{4}$	1	1	$1\frac{1}{2}$	$\frac{5}{8}$
39	$1\frac{1}{2}$	1	1	$1\frac{1}{2}$	$\frac{3}{4}$
40	$1\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{3}{8}$	$\frac{3}{4}$
41	2	1	$1\frac{1}{4}$	$1\frac{1}{4}$	$\frac{7}{8}$
42	$2\frac{1}{4}$	1	$1\frac{1}{2}$	$1\frac{1}{4}$	$\frac{7}{8}$
43	$2\frac{3}{4}$	1	$1\frac{1}{2}$		$\frac{3}{4}$
	3 $10\frac{3}{4}$	44	9		$7\frac{3}{4}$
	14 Cut up				
	2 $8\frac{3}{4}$				

DIMENSIONS FOR CUTTING OUT STAY FORESAIL

(FIG. 7) CALCULATED UPON 18-IN. CANVAS.

No. of Cloths.	Foot Gores.	Stay Gores.		Foot Seams.	Slack Seams.
	Inches.	Ft.	In.	Inches.	Inches.
2/3	3	1	3	1 3/8	
1	4	1	10	1 3/8	
2	3 3/4	1	9 1/2	1 7/16	
3	3 1/2	1	9	1 9/16	
4	3 1/4	1	8 1/2	1 5/8	
5	3	1	8	1 5/8	
6	2 3/4	1	7 1/2	1 5/8	
7	2 1/2	1	7	1 13/16	
8	2 1/4	1	6 1/2	1 13/16	
9	2 1/4	1	6	1 13/16	
10	2	1	6	1 7/8	
11	2	1	6	1 7/8	
12	1 3/4	1	6	1 15/16	
13	1 3/4	1	6	1 15/16	
14	1 1/2	1	6	1 15/16	
15	1 1/2	1	6 1/2	1 15/16	
16	1 1/4	1	6 1/2	1 15/16	
17	1	1	6 1/2	1 15/16	1/8
18	1	1	6 1/2	1 7/8	1/4
19	3/4	1	7	1 7/8	3/8
20	1/2	1	7	1 7/8	1/2
21	0	1	7 1/2	1 15/16	5/8
22	1/2	1	7 1/2	1 15/16	3/4
23	1	1	8	1 5/8	7/8
24	1 3/4	1	8	1 1/2	1
25	2 1/2	1	8 1/2	1 1/2	1
26	3 1/2	1	8 1/2	1 3/8	1 1/8
27	4 3/4	1	8		1 1/8
	3 9 1/4	44	9		7 3/4
	1 2 Cut up				
	2 7 1/4				

DIMENSIONS FOR CUTTING OUT JIB

(FIG. 8) CALCULATED UPON 18-IN. CANVAS.

No. of Cloths.	Foot Gores.		Stay Gores.		Foot Seams.
	Ft.	In.	Ft.	In.	Inches.
1		1	3	3	3
2		2	3	3	2⅞
3		2	3	2	2⅞
4		3	3	2	2¾
5		3	3	1	2¾
6		4	3	1	2⅝
7		4	3	1	2⅝
8		5	3	0	2½
9		6	3	0	2½
10		7	3	0	2⅜
11		8	3	0	2⅜
12		8	2	11½	2¼
13		9	2	11½	2¼
14		9	2	11	2⅛
15		10	2	11	2⅛
16		11	2	10½	2
17	1	0	2	10½	2
18	1	1	2	10	1⅞
19	1	2	2	10	1¾
20	1	3	2	9½	1⅝
21	1	4	2	9	1½
22	1	5	2	8½	1⅜
23	1	6	2	8	1¼
24	1	7	2	7½	1⅛
25	1	9	2	7	1
26	2	0	2	6	
	21	9	75	10½	

DIMENSIONS FOR CUTTING OUT JIB

(Fig. 8) Calculated upon 24-in. Canvas.

No. of Cloths.	Foot Gores. Ft.	Foot Gores. In.	Stay Gores. Ft.	Stay Gores. In.	Foot Seams. Inches.
½		2	2	4	1¼
1		4	4	8	1⅜
2		5	4	7	1¾
3		6	4	6	2
4		7	4	5	2¼
5		8	4	4	2⅜
6		9	4	4	2½
7		10	4	2	2¾
8		11	4	0	2⅞
9	1	0	3	10	3
10	1	1	3	9	3
11	1	2	3	8	3⅛
12	1	3	3	7	3¼
13	1	4	3	6	3¼
14	1	5	3	5	3⅜
15	1	6	3	4	3½
16	1	8	3	4	3½
17	1	10	3	3	3½
18	2	1	3	3	3½
19	2	4	3	2	3⅝
	21	10	75	5	

DIMENSIONS FOR CUTTING OUT DIAGONAL JIB

(Fig. 9) Calculated upon 18-in. Canvas.

No. of Cloths.	Stay Gores (upper part). Ft.	Ins.	Last Gores. Inches.	Stay Gores (lower part.) Ft.	Ins.	Last Seams. Inchss.
⅓	1	0	3	0	8	⅞
1	3	0	9	2	0	1
2	3	0	9	2	0	1
3	2	11	9	2	0½	1⅛
4	2	11	9	2	0½	1⅛
5	2	10½	9	2	1	1¼
6	2	10½	9	2	1	1¼
7	2	10	9	2	1½	1⅜
8	2	10	9	2	1½	1½
9	2	9½	9	2	2	1½
10	2	9½	9	2	2	1⅝
11	2	9	9	2	2½	1⅝
12	2	9	9	2	2½	1⅝
13	2	8	9	2	3	1¾
14	2	7	9	2	3	1¾
15	2	6	9			
	43	1	11 6	30	5	

DIMENSIONS FOR CUTTING OUT DIAGONAL JIB

(Fig. 9) Calculated upon 24-in. Canvas.

No. of Cloths.	Stay Gores (Upper part).		Last Gores.	Stay Gores. (Lower part).		Last Seams
	Ft.	In.	Inches.	Ft.	In.	Inches.
¾	3	1	8½	1	11	⅞
1	4	1	11½	2	6	1
2	4	0	11½	2	7	1⅛
3	3	11	11½	2	8	1¼
4	3	10	11½	2	9	1⅜
5	3	9	11½	2	10	1½
6	3	8	11½	2	11	1⅝
7	3	7	11½	3	0	1¾
8	3	6	11½	3	1	1⅞
9	3	5	11½	3	2	2
10	3	4	11½	3	3	2⅛
11	3	3	11½		0	
	43	5	11 3	30	8	

DIMENSIONS FOR CUTTING OUT YARD TOPSAIL

(Fig. 10) Calculated upon 18-in. Canvas.

No. of Cloths.	Foot Gores.	Mast Gores.		Head Gores.		Foot Seams.	Head Seams.
	Inches.	Ft.	In.	Ft.	In.	Inches.	Inches.
1	4½	4	4			2¾	
2	5	4	4			2⅞	
3	5	4	4			2⅞	
4	5½	4	4			3	
5	5½	4	4			3	
6	6	⅓ 1	6	⅔ 1	4	3⅛	¾
7	6	23	2	1	10½	3⅛	¾
8	6			1	10½	3⅛	¾
9	6			1	9½	3⅛	⅞
10	6			1	9½	3	1
11	6			1	9	3	1⅛
12	6			1	9	2⅞	1⅝
13	6			1	8½	2⅞	1⅝
14	6			1	8½	2¾	1⅞
15	6			1	8	2⅝	2
16	6½			1	8	2½	2
17	6½			1	7½	2⅜	2⅛
18	6½			1	7½	2¼	2⅛
19	7			1	7	2⅛	2¼
20	7			1	7	2	2¼
21	7½			1	6½	1⅞	2⅜
22	7½			1	6½	1¾	2½
23	8			1	6	1⅝	2½
24	8			1	6	1½	2⅝
25	8½			1	5½	1⅜	2⅝
26	8½			1	5½	1¼	2¾
27	9			1	5	⅞	2¾
28	10			1	5		
	15 6			37	2		

DIMENSIONS FOR CUTTING OUT YARD TOPSAIL

(Fig. 10) Calculated upon 24-in. Canvas.

No. of Cloths.	Foot Gores. Inches.	Mast Gores. Ft. In.	Head Gores. Ft. In.	Foot Seams. Inches.	Head Seams. Inches.
¾	3	5 5		3 1/16	
1	4	7 1		3⅝	
2	4½	7 1		3⅝	
3	5	3 9 ½	11	3½	1⅛
4	5½	23 4	2 10	3⅜	1¼
5	6		2 9	3⅜	1⅜
6	6½		2 8	3¼	1⅝
7	7		2 7	3⅛	1⅞
8	7½		2 6	3	2⅛
9	8		2 5	2⅞	2⅜
10	8½		2 4	2¾	2⅝
11	9		2 3	2⅝	2¾
12	9½		2 2	2½	2⅞
13	10		2 1	2⅜	3
14	10½		2 0	2⅛	3¼
15	11		1 10½	2	3⅜
16	1 0		1 9	1¾	3½
17	1 1		1 7½	1½	3⅝
18	1 2½		1 6	1⅜	3¾
19	1 4		1 4	1 3/16	3⅞
20	1 6		1 2		
	15 9		36 9		

DIMENSIONS FOR CUTTING OUT JIB-HEADED TOPSAIL

(FIG. 11) CALCULATED UPON 18-IN. CANVAS.

No. of Cloths.	Foot Gores. Inches.	Mast Gores. Inches.	Foot Seams. Inches.
¾	8	6½	1
1	9	9	1⅛
2	8	9	1¼
3	7	8½	1½
4	6½	8½	1⅝
5	6½	8	1⅝
6	6	8	1¾
7	6	8	1¾
8	5½	8	2
9	5½	7½	2
10	5¼	7½	2⅛
11	5¼	7	2⅛
12	5	7	2¼
13	5	7	2⅜
14	4¾	7	2½
15	4¾	7	2½
16	4½	7	2⅝
17	4½	7½	2⅝
18	4¼	7½	2¾
19	4¼	8	2⅝
20	4	8	2⅝
21	4	8	2⅝
22	3¾	8½	2⅝
23	3¾	8½	2⅝
24	3½	8½	2⅜
25	3½	8½	2
26	3¼	8½	1⅜
27	3¼	8	1⅛
28	3	8	
	12 3½	19	

DIMENSIONS FOR CUTTING OUT JIB-HEADED TOPSAIL

(FIG. 11) CALCULATED UPON 24-IN. CANVAS.

No. of Cloths.	Foot Gores. Ft.	Foot Gores. In.	Mast Gores. Inches.	Foot Seams. Inches.
¼		4	3	$1\frac{5}{16}$
1	1	3	12	1½
2	1	1	12	1⅝
3		11	11½	1⅞
4		10	11½	2
5		9	11	2⅛
6		9	11	2¼
7		8	10½	2½
8		8	10½	2¾
9		7	10½	2⅞
10		7	10½	3
11		6	10	3⅛
12		6	10	3¼
13		5	10½	3¼
14		5	10½	3¼
15		4	10½	3
16		4	10½	2¾
17		3½	11	2¼
18		3	11	1⅞
19		2½	11½	1½
20		2	11½	$1\frac{3}{16}$
21		1	12	
	11	11	19 5	

DIMENSIONS FOR CUTTING OUT BARGE'S TOPSAIL

(Fig. 12) Calculated upon 24-in. Canvas.

No. of Cloths.	Foot Gores. Ft.	Foot Gores. In.	Mast Gores. Ft.	Mast Gores. In.	Head Gores. Inches.	Foot Seams. Inches.
1	1	3	1	3		1½
2	1	1	1	2½		1⅜
3		11	1	2½		1¾
4		10	1	2		2
5		9	1	2		2⅛
6		8	1	1½		2¼
7		7	1	1½		2½
8		7	1	1½		2⅝
9		6	1	2		2¾
10		6	1	2		3
11		5	1	2½		3⅛
12		5	1	3		3¼
13		4½		10½	2½	3¼
14		4	15	0	5	2⅞
15		3			5	2½
16		3			5	2⅛
17		2			5	
	9	10			22½	

DIMENSIONS FOR CUTTING OUT BALANCE LUG

(Fig. 13) Calculated upon 12-in. Canvas.

No. of Cloths.	Foot Gores. Inches.	Mast Gores. Ft.	Mast Gores. In.	Head Gores. Ft.	Head Gores. In.	Foot Seams. Inches.	Head. Seams. Inches.
1	7¾	1	8			⅞	
2	7¾	1	6			1	
3	7½	1	6			1¼	
4	7¼	1	8			1½	
5	7	6	4	1	4	1⅝	1
6	6¾			1	3	1¾	1½
7	6½			1	2	1⅞	1⅞
8	6¼			1	1	1⅞	2⅛
9	6			1	0	2	2⅜
10	5¾				11	2	2½
11	5¾				10	2⅛	2⅝
12	5½				10	1⅞	2¾
13	5¼				10	1½	2⅞
14	5				9	1⅛	3
15	5				8	⅞	3⅛
16	5				7		
	8 4			11	3		

DIMENSIONS FOR CUTTING OUT LUG SAIL

(FIG. 14) CALCULATED UPON 12-IN. CANVAS.

No. of Cloths.	Foot Gores. Inches.	Mast Gores. Ft.	Mast Gores. In.	Head Gores. Ft.	Head Gores. In.	Foot Seams. Inches.	Head. Seams. Inches.
½	7		9			⅞	
1	12	1	6			1⅜	
2	11	1	6			1½	
3	10	1	8			1⅝	
4	9½	5	5	1	5	1⅞	¾
5	9			1	4	2	¾
6	8½			1	3	2¼	⅞
7	8			1	2	2½	⅞
8	7½			1	1	2⅞	1
9	7			1	0	3	1
10	6½			1	0	3⅛	1
11	6				11	3¼	1⅛
12	5½				11	3¼	1⅛
13	5				10	2¾	1⅛
14	4½				10	2⅜	1¼
15	4				9	1¾	1¼
16	3½				9	1¼	1¼
17	3				8	1	1⅜
18	2½				8		
	10 10			14	7		

CHAPTER IX.

ON ROPING.

IMPORTANCE OF ADJUSTING ROPE TO STRAIN APPLIED—TREATMENT OF ROPE—ROPING OF CUTTER YACHT'S MAINSAIL (ROUND FOOT), CUTTER YACHT'S MAINSAIL (LACED FOOT), YAWL YACHT'S MAINSAIL, BARGE'S SPRIT MAINSAIL, YACHT'S STAY FORESAIL, JIB (ORDINARY CUT), JIB (DIAGONAL CUT), YARD TOPSAIL, JIB-HEADED TOPSAIL, BARGE'S TOPSAIL, BALANCE LUG AND LUG SAIL.

IT is very important in producing flat and lifting sails to know what sized rope is required for the strain which will be applied, and also to know how to put it on. This knowledge can only be acquired by close observation and practice. It need hardly be said that the best bolt-rope obtainable should be used.*

All sailmakers will admit that, however nearly sails may be calculated and put together, if roped by an inexperienced man they will be practically spoiled. The author has endeavoured to deal with this subject in as simple a form as possible, and has given tables of ropes suitable for sails in Chapter I. The roping of each sail has also been shown and calculated from drawings (Figs. 3 to 14, Chapter IV.).

The question may arise in the mind of a student why a rope upon a sail needs to be put on tighter at certain parts than others. The answer is that there are forces affecting such parts of the canvas which displace the threads and cause those parts to stretch, while other threads are not affected on account of the pressure of the wind plying in the opposite direction upon the canvas. The study of mechanics will make this truth plain.

There are strains working against strains upon all sails, and therefore a careful sailmaker will find out if the strain at any particular point will cause the canvas to stretch, and to what extent, which will enable him to judge how to put on the rope so as to be fair when fully stretched.

---

* That manufactured by Messrs. G. Langford and Son, of Portsmouth, is strongly recommended.

ROPING OF MAINSAIL

(Fig. 3).

This sail is treated throughout as that of a large racing cutter-yacht's mainsail, therefore in the roping the allowance is made for the great strain such as is applied to sails of this class.

The size of the rope required upon the mast is 5 in. Prepare the same by turning it out and fairly rounding it in again, for the purpose of making it workable. It is as well to have a chalk line marked upon it, to make sure of keeping the same lay throughout, especially for those who have not had much practice at roping, as great skill is required to enable the sailmaker to rope exactly.

The best way of putting ropes on, is to mark each yard up and allow the amount of the slack rope or cloth, whichever is needed, as one proceeds.

The following figures give the amount of the slack cloth required per yard upon the mast of the sail :—

Rope. Yards.	Slack Cloth. Inches.
1	5
2	4¾
3	4½
4	4¼
5	4
6	3¾
7	3½
8	3¼
9	3
10	2¾
11	2½
12	2¼
13	2
13⅔	1½
	47

The mast rope continued upon the head should be sewn on even with the canvas.

The head rope should be calculated: for instance, the head of the sail will give out 34 in., and the size of the rope to be put on is 2 in., which will stretch at the rate of 2 in. per yard. After deducting the length of the mast and peek ropes upon head, and allowing for these to stretch 2½ in., it will give about 14 yards of head rope, which will give out 28 in. It, therefore, wants 3½ in. of slack rope to be sewn upon the head, as given by the following figures:—

Rope. Yards.	Slack Rope. Inches.	
1	$\frac{7}{8}$	
2	$\frac{3}{4}$	
3	$\frac{5}{8}$	
4	$\frac{5}{8}$	
5	$\frac{1}{2}$	
6	$\frac{3}{8}$	
7	$\frac{1}{4}$	
8	$\frac{1}{8}$	
9	$\frac{1}{8}$	
10	0	
11	0	
12	$\frac{1}{8}$	Slack Cloth.
13	$\frac{1}{4}$	
14	$\frac{3}{8}$	
	$4\frac{1}{4}$	
	$\frac{3}{4}$	
	$3\frac{1}{2}$	

The size of the peek rope should be about 4 in., and sewn on a little slack. Special care should be taken, when sewing over the peek splice and tail upon the leech, that it is sewn on long-jawed at the top of the splice, and gradually lessened towards end. The size of the clew rope, which is 6 in., should be commenced by putting it on a little slack, and gradually throwing it off until the splice is passed.

There should be no slack canvas taken in above the square line of tack, but from that point slack canvas should be taken in gradually down to the clew. The greatest amount of slack cloth taken in is at the clew, at the rate of 2 in. per yard of rope.

The foot tabling should be cut off and turned, sewing it on by the same thread as the sail to which it will be attached. The foot splice and tails must be sewn on slack, according to the gores.

ROPING OF MAINSAIL

(Fig. 4).

This sail, being of the same size as No. 1 mainsail, is treated upon the mast in the same manner. The head of the sail is calculated to give out at the rate of 2 in. per foot of the peek gore, there being no slack seam, thus the head will give out 42 in. Allow for the mast and peek ropes to give out 2½ in. upon the head.

Calculating for the 14 yards of head rope at 2 in. and stretching 28 in., it requires 11½ in. of slack rope to be sewn upon the head. Figures as given :—

Rope. Yards.		Slack Rope. Inches.
1	... ...	1⅝
2	... ...	1⅜
3	... ...	1¼
4	... .	1¼
5	... ...	1⅛
6	... ...	1⅛
7	... ...	1
8	... ...	¾
9	... ...	⅝
10	... ...	½
11	... ...	⅜
12	... ...	¼
13	... ...	⅛
14	... .	⅛
		11½

The peek and the clew ropes are treated as those of No. 1 mainsail.

A foot rope is needed upon this sail, the size of which is 2 in., calculating the foot to stretch 32 in.; and reckoning the rope at 17 yards, giving out at the rate of 2 in. per yard, it will stretch 34 in., thus requiring the rope to be put on 2 in. tight, at the rate of ⅛ in. slack cloth per yard of the rope.

ROPING OF YAWL'S MAINSAIL

(FIG. 5).

The mast rope for this sail is 4½ in., which should be put on in the under-mentioned proportion :—

Rope.	Slack Cloth.
Yards.	Inches.
1	4½
2	4½
3	4¼
4	4
5	3¾
6	3½
7	3¼
8	3
9	2¾
10	2½
11	2¼
12	2
13	1¾
13¾	1⅛
	43⅛

The head rope should be 1⅞ in., which must be calculated according to the gore of the sail. The peek gore is 22 ft. 3 in.; after deducting 2 ft. 3 in., the amount of slack seam, it equals 20 ft., which will give out 2 in. per foot of gore, making 40 in. The head rope will stretch the amount of its size in circumference per yard of the length.

After allowing for the mast and peek ropes upon the head, which should be sewn on even, calculating them to give out 2½ in., there is left about 12 yards of clear head rope, which will stretch 22½ in., thus requiring the rope to be put on 15 in. slack, to make the correct allowance—viz., 37½ in.—to be sewn on, as shown by the following figures :—

Rope.	Slack Rope.
Yards.	Inches.
1	2½
2	2¼
3	2
4	1⅝
5	1⅜
6	1⅛
7	1
8	⅞
9	¾
10	⅝
11	½
12	⅜
	15

The clew rope, which is 5½ in., should be sewn on above the upper reef, in a similar manner to that of No. 1 mainsail. From the upper reef it must be put on gradually tighter down to the clew. The last yard should be sewn on with 2½ in. of slack cloth.

ROPING OF SPRIT BARGE'S MAINSAIL

(Fig. 6).

The size of the mast rope for this sail is 3¼ in., which is sewn on as follows :—

Rope.	Slack Cloth.
Yards.	Inches.
1	3¼
2	3
3	2½
4	2¼
5	2
6	1¾
7	1½
8	1¼
	17½

The head of the sail will give out at the rate of 2 in. per foot of the peek gore, which is 24 ft. Reduce by amount of slack, viz., 7½ in., and the head will therefore stretch about 47 in. The rope, which is 7½ in., will give out two-thirds of its size in circumference per yard of the length where the greatest strain is applied, which is nearest the throat. Rope should be put on as under :—

Rope. Yards.	Slack Cloth. Inches.	
1	1	
2	¾	
3	½	
4	¼	
5	0	
6	0	Even.
7	0	
8	0	
9	¼	Slack Rope.
10	½	
⅔	½	
	2½	
	1¼	
	1¼	

The leech rope needs to be one size throughout—viz., 4 in.—and should be sewn on as follows :—

Rope. Yards.	Slack Rope. Inches.	Rope. Yards.	Slack Rope. Inches.	
1	1¾	9	0	Even.
2	1½	10	0	
3	1¼	11	0	
4	1	12	0	
5	¾	13	0	
6	½	14	¼	Tight.
7	¼	15	½	
8	⅛	16	¾	
		17	1	
			7⅛	
			2½	
			4⅝	

The foot rope should be put on slack.

ROPING OF YACHT'S STAY FORESAIL

(Fig. 7).

The size of the stay rope is 3 in., to be sewn on as under:—

Rope.	Slack Cloth.	Rope.	Slack Cloth.
Yards.	Inches.	Yards.	Inches.
1	3	11	1¾
2	3	12	1¾
3	2¾	13	1½
4	2¾	14	1½
5	2½	15	1¼
6	2½	16	1¼
7	2¼	17	1
8	2¼	18	1
9	2		36
10	2		

The clew rope is 3¼ in., and should be commenced even at the tail and gradually made to bear. The last yard should have **1** in. of slack cloth.

ROPING OF JIB (ORDINARY CUT)

(Fig. 8).

The size of stay rope is 5 in., which should be sewn on as under:—

Rope.	Slack Cloth.	Rope.	Slack Cloth.
Yards.	Inches.	Yards.	Inches.
1	1¾	15	4¼
2	2¼	16	4
3	2¾	17	3¾
4	3¼	18	3½
5	4	19	3¼
6	4¾	20	3
7	5½	21	2¾
8	5½	22	2½
9	5¼	23	2¼
10	5¼	24	2
11	5	25	1¾
12	5		7 8½
13	4¾		
14	4½		

The tail of the clew rope should be commenced slack, and gradually sewn so as to bear at clew.

ROPING OF DIAGONAL JIB

(FIG. 9).

The stay rope for this sail is 5 in., and should be put on as under:—

Rope. Yards.	Slack Cloth. Inches.
1	1¾
2	2
3	2½
4	3
5	3½
6	4
7	4¼
8	4¾
9	5
10	5¼
11	5½
12	5½
13	5¼
14	5
15	4¼
16	4
17	3¾
18	3½
19	3¼
20	3
21	2¾
22	2½
23	2¼
24	2
25	1¾
	7 6¼

The tail of the clew rope should be commenced slack, and gradually put on so as to bear at clew.

ROPING OF YARD TOPSAIL

(FIG. 10).

The size of mast rope is 3 in., and should be sewn on as under:—

Rope. Yards.	Slack Cloth. Inches.
1	½
2	¾
3	1
4	1¼
5	1½
6	1¾
7	2
½	1
	9¾

The size of the head rope is 1½ in., and it should be put on ¼ in. slack per yard. The clew rope, the size of which is 2¼ in., should be commenced slack, and gradually tightened, so that the last yard at clew has 1 in. slack cloth.

ROPING OF JIB-HEADED TOPSAIL

(Fig. 11).

The mast rope is 2¾ in., and should be sewn on as follows :—

Rope. Yards.	Slack Cloth. Inches.
1	1¼
2	1½
3	1¾
4	2
5	2¼
6	2½
7	2¾
8	2½
9	2¼
10	2
11	1¾
12	1½
13	1¼
14	1
	26¼

The clew rope should be put on even, and foot rope, if any, slack.

ROPING OF BARGE'S TOPSAIL

(Fig. 12).

The size of the mast rope is 2¾ in., and it should be sewn on as follows :—

Rope. Yards.	Slack Cloth. Inches.
1	2
2	2¼
3	2½
4	2¾
5	2½
6	2¼
7	2
8	1¾
	18

The head rope, which is a continuance of the mast rope, should be put on even. The leech rope is 1¾ in., and is sewn on ½ in. slack rope per yard of length. The clew rope is even with sail. The foot rope is 1¾ in., to be put on slack.

ROPING OF BALANCE LUG

(Fig. 13).

The mast rope is 1¾ in., and should be sewn on 1¾ in. slack cloth per yard of rope. The size of the head rope is ⅞ in., and it should be put on as under:—

Rope.	Slack Rope.
Yards.	Inches.
1	3
2	2¾
3	2½
4	2¼
5	2
6	1¾
7	1¼
	15½

The clew rope is 1¾ in., and should be commenced slack and gradually tightened towards clew, so that the last yard has ¾ in. of slack cloth.

ROPING OF LUG

(Fig. 14).

The size of the mast rope is 1¾ in., to be sewn on 1¾ in. slack cloth per yard of rope. The head rope is ⅞ in., to be put on quite even. The clew rope is 1¾ in., to be commenced slack at the tail and brought even at clew.

CHAPTER X.

ON DIAGONAL-CUT SAILS.

Remarks upon Cutter and Yawl or Ketch's Mainsails, Foresail, Jib-Headed and Yard Topsails and Jib—Number of Cloths Required—Allowances—Calculation of Gores—Cutting Out and Roping of same.

There is nothing to be said in favour of diagonal-cut sails over those of the ordinary cut as regards their flat and lifting qualities. One advantage is gained, however, in the case of a mainsail for North Sea fishing and large coasting vessels, as the sail is not so likely to split upon the foot when the craft is lurching and plunging about. Another advantage is that should the sail split, the cross seam is a safeguard against the sail rending from top to bottom or across.

In cutting a high-sheeted jib by this method the foot gore is dispensed with, and as the proper treatment of the foot gore is a difficulty with the majority of sailmakers, a sail of that kind is more simple to construct.

It is necessary, however, to have a knowledge of the stretching tendency of the gore upon the foot before proper allowances can be made, as the amount of flow needed to the stay depends upon the quantity of the foot gore.

Many jibs are made that girt across from the sheet to the stay, which is caused by not making sufficient allowances for the giving-out of the foot. Cutting them diagonally does away to a great extent with the likelihood of this occurring, as the gores of the lower part of the jib will not give out so much, and consequently so great a flow is not required.

The stretching of the last gores does not materially affect the standing of the jib, as the position of the stay is unaltered. The gores stretching towards the sheet give an unsightly appearance to the sail, unless treated in its manufacture. Appearances must be studied as well as effect in order to give satisfaction.

It is necessary to draw these sails by straight lines in order to get a true calculation of the allowances required for the stretching of the gores. It is not essential to show, or even determine, the amount of round to the foot before getting the calculation of allowances and the gores, as is the case in an ordinary-cut sail.

CUTTER'S MAINSAIL.

The circular line upon the clew of the cutter's mainsail—as on *all* the drawings—is for the purpose of arriving at the right position of the last gores, which is obtained by extending the legs of a pair of compasses to an indefinite distance, fixing one point at the clew and marking with the other from the leech to the foot line. Get the central position upon the circular line with the compasses, from the points of the circular mark on the leech and foot. Strike a straight line from the clew through the centre of the circular mark to the mast (*b*), which will give the position of the last seam. Square from the leech line to the mast (*b*), which will give the length of the gore upon leech, viz., 36 ft. 6 in.

To arrive at the quantity of mast gore needed, measure the same length of line upon the foot as upon leech (36 ft. 6 in.), which will give 2 ft. of mast gore.

To find the number of cloths for the mast relative to the last, measure the length of line from the leech to mast (*a* to *b*), and mark the same length from *b* to *c* at a similar distance from the clew as *a* upon leech. Mark a straight line from the clew to the end of line from *b* to *c*, which show that the mast does not require the same number of cloths as the last by about 15 in.

The requisite number of cloths for the head is obtained by squaring from the leech to the throat (*g* to *h*). To determine what mast gore is required, square from the line (*g* to *h*) at point *h* to line *a* to *b*.

The mark inside the leech line, from *g* to the head, shows the amount of stretch upon head. The star indicates the centre of effort. The line across the sail from *e* to *i* is the line of pressure. The lines from *e* to *f* towards the clew and upon the last line show the amount of stretch at the clew. Lines from *d* to *e* and *f* are those from which the wide seams should be commenced for the giving-out of the last gores. The line from the tack to the letter *o* is for the calculation of the slack seams.

YAWL OR KETCH'S MAINSAIL.

The lines upon this sail are similar to those upon the cutters, and are arrived at in the same way, which can be seen from the calculation of the allowances.

FORESAIL.

The circular line upon the sail at the clew is for the purpose of getting the position of the last seam, which extends to the stay (*b*). Line *a* to *b* is squared from the leech, which determines the length of the last gore marked upon leech 14 ft. 8 in., and also the stay gore ofthe upper part marked 15 ft. 9 in.

From *b* to *c* is the corresponding line to that from *a* to *b*, and determines the amount of stay gore upon the lower part marked 11 ft. 3 in.

From *a* to *f* is the line of pressure, and the star the centre of effort.

From *d* to *o*, and from *o* to *e*, are the lines from which the wide seams commence for the giving-out of the gores at clew.

From *d* to *e* towards clue and upon the last seam indicates the extent of the stretching of the clew.

The line running from clew towards and below the tack shows the difference of cloth required upon the stay to that of the last.

JIB-HEADED TOPSAIL.

Lines upon this sail represent in every particular those upon the foresail already described, save that the centre of effort is upon the lower angle of topsail.

YARD TOPSAIL.

Lines within the area of *a* to *b* and *b* to *c* are similar to the sails previously mentioned. Line from *d* to *o* is squared from the line *b* to *c*, and gives the head gore upon the lower part, viz., 11 ft. 10 in. From *d* to *f* is squared from *o* to *d*, and gives amount of the mast gore, which is 7 ft.

The line from the clew to *e* upon the mast shows that more cloth is needed at the mast than at the last.

JIB.

The lines upon this sail are identical with those already explained, with the exception of the stay lines.

The centre is the straight line by which the sail was first drawn. The outer line shows the extent of flow. The inner line indicates the position of the head and tack when spread, as the amount of flow is calculated from that line to the outer one, which is explained in the allowances.

Fig. 18.—CUTTER'S MAINSAIL (diagonal cut).

(Scale, $\frac{1}{8}$ in. per foot.)

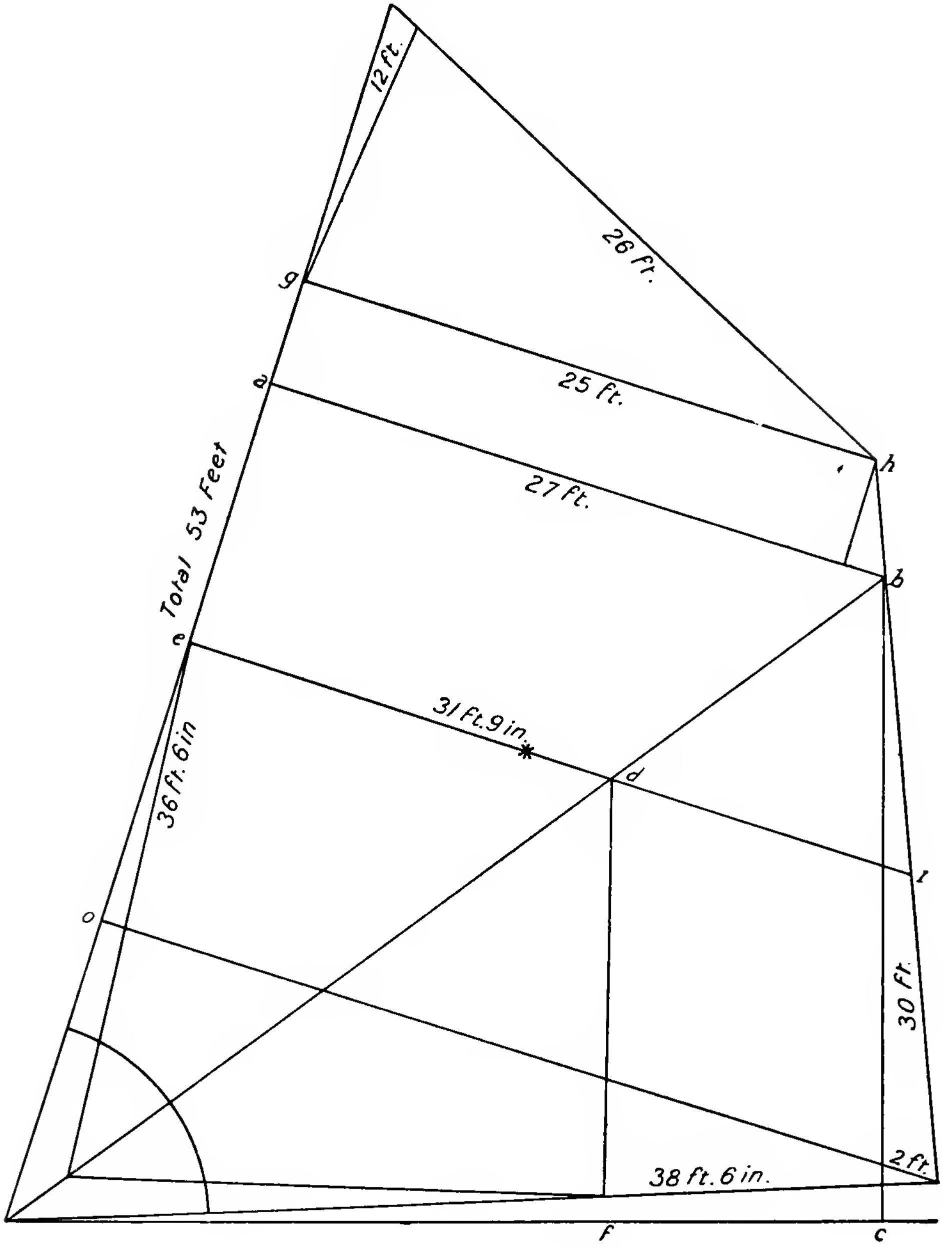


Fig. 15.—YAWL or KETCH'S MAINSAIL (diagonal cut).

(Scale, $\frac{1}{8}$ in. per foot.)

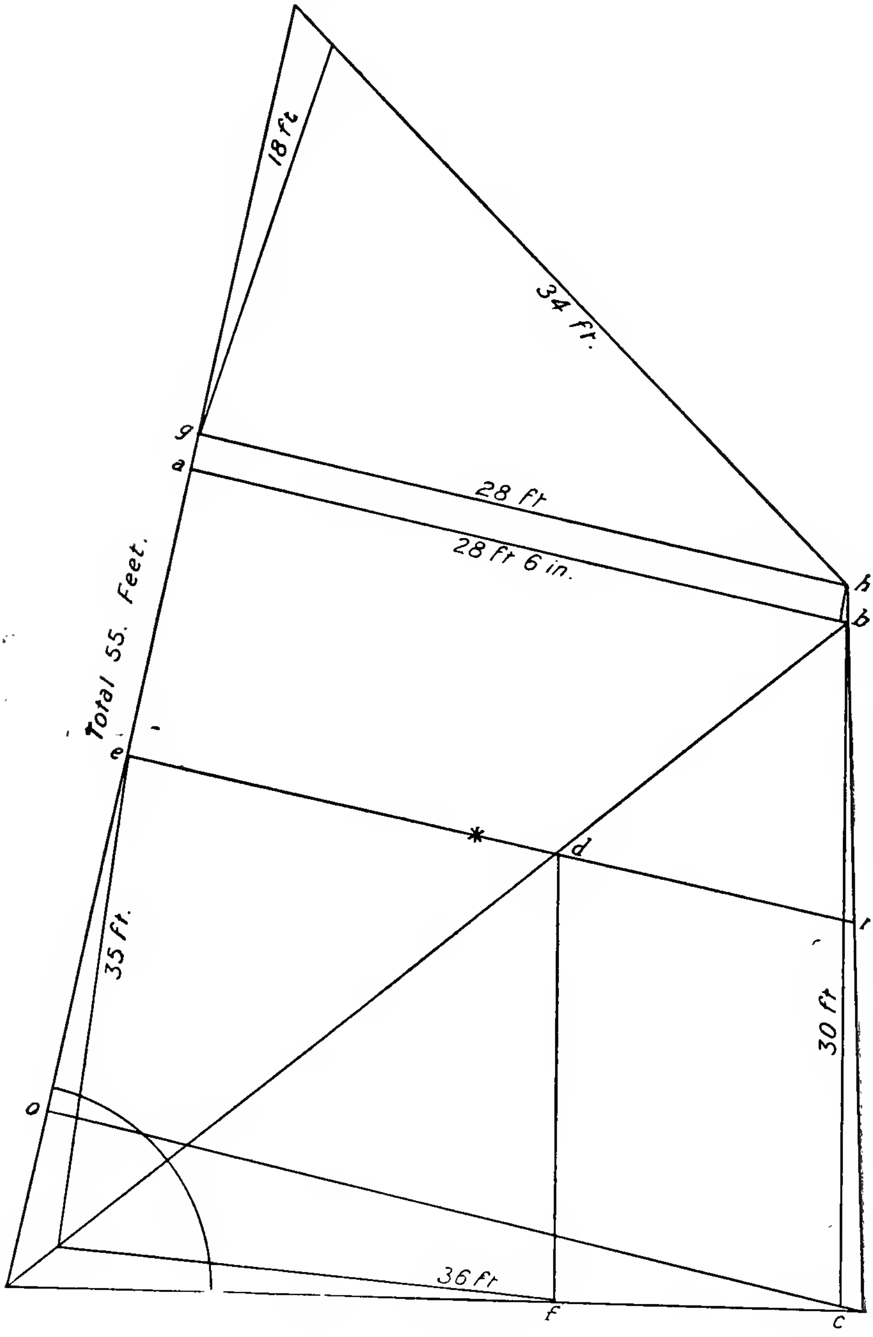


Fig. 20.—FORESAIL (diagonal cut).

(Scale, ⅛ in. per foot.)

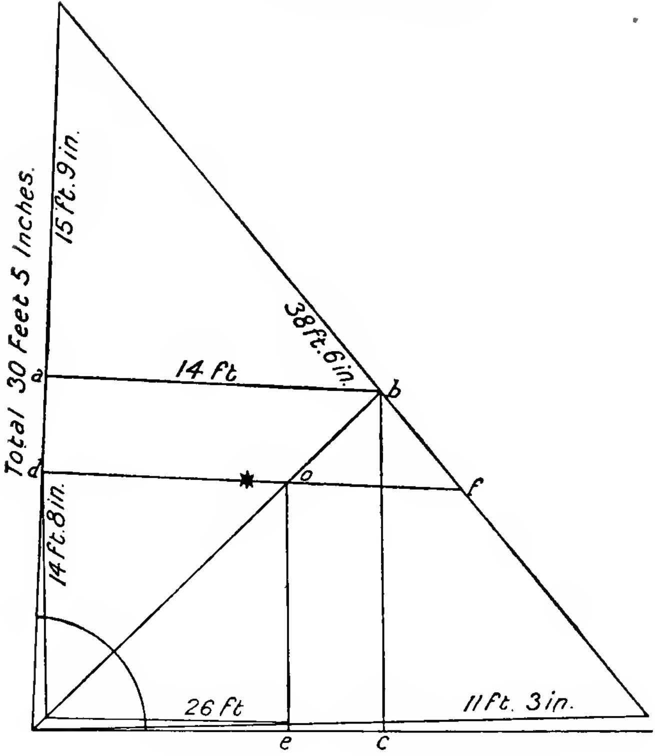


Fig. 21.—JIB-HEADED TOPSAIL (diagonal cut).

(Scale, ⅛ in. per foot.)

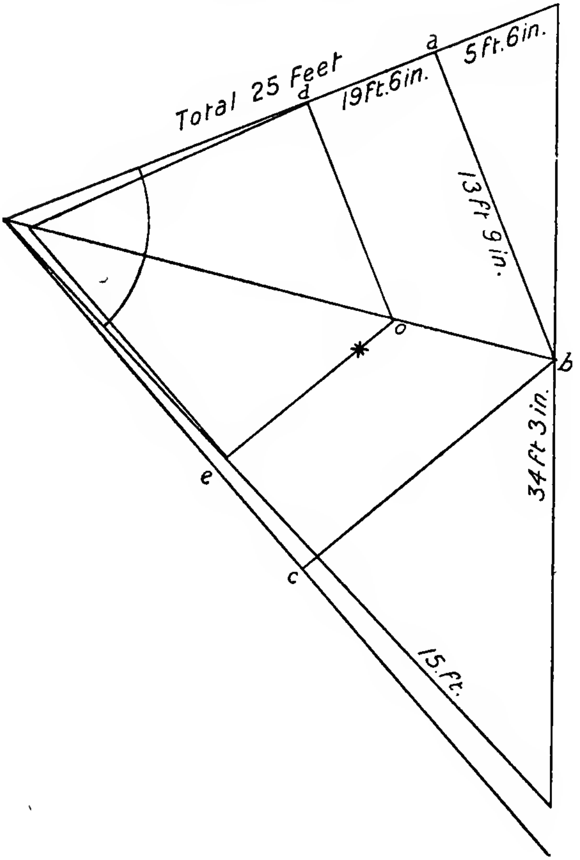


Fig. 22.—**YARD TOPSAIL** (diagonal cut).

(Scale, $\frac{1}{8}$ in. per foot.)

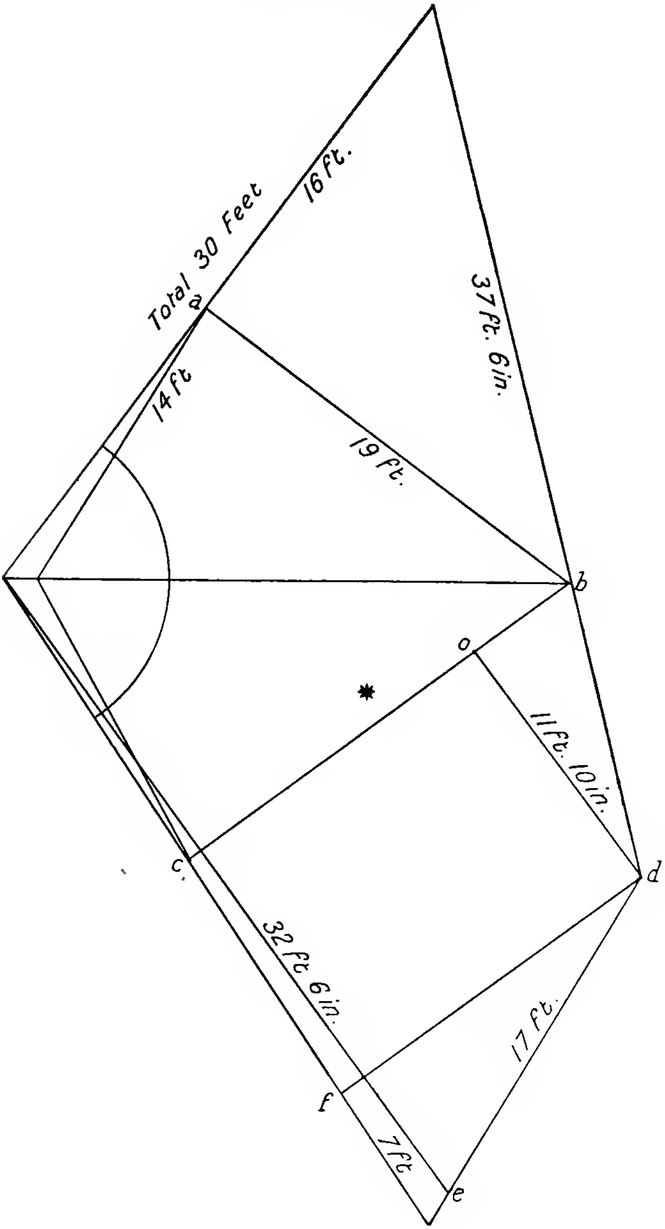
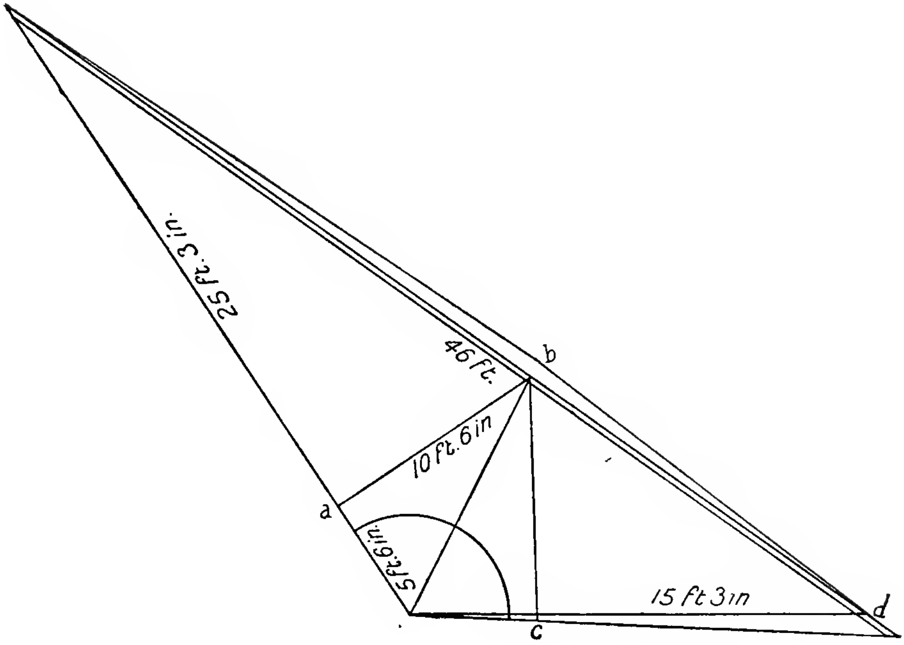


Fig. 23.—JIB (diagonal cut).

(Scale, $\frac{1}{8}$ in. per foot.)



CUTTER'S MAINSAIL.

(Fig. 18.)

The number of cloths required for this mainsail upon 24 in. canvas are arrived at as follows :—

		Feet.	Inches.
Add together, Length of Line, *a* to *b*		27	0
Leech and Mast Tablings		0	8
14 Seams, 1⅜ wide		1	7¼
Divide by Width of Canvas	2)	29	3¼
(Giving barely 14¾ Cloths)		14	15¼

The mast does not need so much cloth by 18 in. as does the last.

YAWL OR KETCH'S MAINSAIL.

(Fig. 19.)

The number of cloths required for this mainsail are obtained as under :—

		Feet.	Inches.
Length of Line, *a* to *b*		28	6
Leech and Mast Tablings		0	8
15 Seams, 1⅜ inch wide		1	8½
Width of Canvas	2)	30	10½
(Barely 15½ Cloths)		15	10½

The last cloth is even with that of the mast.

FORESAIL.

(Fig. 20.)

The number of cloths required is arrived at as follows :—

		Feet.	Inches.
Length of Line, *a* to *b*		16	2
Leech and Stay Tablings		0	8
8 Seams, 1¼ inch wide		0	10
Width of Canvas	2)	17	8
(8¾ Cloths)		8	18

There is not so much cloth needed at the tack by 5 in. as at the last.

JIB-HEADED TOPSAIL.

(Fig. 21.)

The number of cloths required for this sail are obtained as follows :—

		Feet.	Inches.
Length of Line, *a* to *b*		13	9
Leech and Mast Tablings		0	8
7 Seams, 1 inch wide		0	7
Width of Canvas ...	2)	15	1
(7½ Cloths)		7	12

The lower part of this sail at the mast needs only 6¾ cloths.

YARD TOPSAIL.

(Fig. 22.)

The number of cloths required for this sail are as under :—

		Feet.	Inches.
Length of Line, *a* to *b*		19	0
Leech and Head Tablings		0	8
9 Seams, 1 inch wide		0	9
Width of Canvas ...	2)	20	5
(Barely 10¼ Cloths) ...		10	5

The lower part of this sail needs 11 cloths at the tack.

JIB.

(Fig. 23.)

The number of cloths required are as follows :—

		Feet.	Inches.
Length of Line, *a* to *b*		10	6
Leech and Stay Tablings		0	8
5 Seams, ¾ inch wide		0	3¾
Width of Canvas ...	2)	11	5¾
(5¾ Cloths)		5	17¾

The lower part of the above sail needs 6¼ cloths at the tack.

CUTTER'S MAINSAIL.

The allowances requisite for stretching, &c., are as follows:—

The head will give out at the rate of 2 in. per foot of the peek gore, which is 12 ft. Reduce by the quantity of slack seams taken in, which is at the rate of 3 in. per foot of the distance from the clew to *o* upon the leech. The line is squared from the leech to tack, and gives 13 ft., which, deducted from the peek gore, gives the amount of stretch as 17½ in., which must be taken in by the seams and leech tabling, commencing to widen the seams upon the line *h* to *g*.

To arrive at the necessary allowance for the stretching of the gores at clew, the centre of effort must first be found, which is shown upon the drawing by a star. Square from the leech to mast, marking so that the line is struck through the centre (*e* to *i*). The allowance needed is at the rate of 1½ in. per foot of the length of line from *e* upon leech to the star at centre, which is 14 ft. 6 in., giving the stretching tendency at 21¾ in. This is from a square of the leech and foot lines to the last seam, and should be taken in by the seams and tablings, commencing to widen at the lines *d* to *e* upon the upper part, and *d* to *f* upon the lower, as the strain is across the canvas inside *d* to mast, so that no seam allowance is needed. The amount of hollow required to the mast for the pressure of wind at centre is at the rate of a ¼ in. per ft. of the length of line across the sail *i* to *e*, viz., 31 ft. 9 in. Add ¼ in. per ft. of the length from clew to *o* upon leech (13 ft.), which will give the amount of hollow needed, viz., 11¼ in. bare. The round required to the head is at the rate of ¼ in. per ft. of the length of the gaff.

The mast of the sail must be regulated to the class of vessel for which the sail is intended. For a coasting vessel, where the truss is much used, the mast will not stretch, but where a vessel has the main tack set in tight the mast will stretch about 6 in.

The seam allowance is as under :—

No. of Seams.		Head Seams. Inches.		Last Seams. Inches.
1	...	⅜		
2	...	½		
3	...	⅝		
4	...	¾		
5	...	⅞	...	¼
6	...	1	...	¾
7	...	1⅛	...	1⅛
8	...	1¼	...	1½
9	...	1⅜	...	1⅞
10	...	1½	...	2¼
11	...	1⅝	...	2⅝
12	...	1¾	...	3
13	...	1¾	...	3⅜
14	Leech Tabling	3	Leech Tabling	5
		17½		21¾

YAWL OR KETCH'S MAINSAIL.

The allowances necessary for the stretching of the gores are arrived at by the same method, and are at the same rate as for utter's mainsail.

The seam allowance is as follows :—

No. of Seams.		Head Seams. Inches.		Last Seams. Inches.
1	...	0		
2	...	¾		
3	...	1¼		
4	...	1⅜		
5	...	1½		
6	...	1⅝		
7	...	1¾	...	⅜
8	...	1⅞	...	¾
9	...	2	...	1¼
10	..	2⅛	...	1⅝
11	...	2¼	...	2
12	...	2⅜	...	2⅜
13	...	2½	...	2¾
14	...	2⅝	...	3⅛
15	...	2¾	..	3½
16	Leech Tabling	5¾	Leech Tabling	5¼
		32½		23

FORESAIL.

The allowances required for the stretching of the gores at the clew should be calculated upon the same principle as the mainsails. The stretch being only 1 in. per ft. of the length of the line from leech (*d*) to the star at centre, which is 8 ft. 6 in.; the allowance to be taken in by the seams and tablings is 8½ in., commencing to widen the seams upon the line leading from *o* to *d* for the upper part, and from *o* to *e* upon the lower part. The hollow needed at the stay to counteract the wind's pressure at centre is at the rate of ¼ in. per ft. of the length of line from the stay to leech (*f* to *d*), which is 17 ft. 6 in.; adding ¼ in. per ft. of the distance from the clew to a square from the leech to tack, which is 1 ft. 6 in., the necessary hollow to stay will be 4¾ in. The slack seam required for the wind's exit out of the after leech is at the rate of 3 in. per foot of the distance from the clew up the leech upon a square of the tack, which gives 4½ in. to be commenced at the centre, the greatest portion being taken in above.

The seam allowance for the giving out of the gores at the last are as under:—

No. of Seams.		Last Seams. Inches.
1	... ...	⅜
2	... ...	⅞
3	... ...	1½
4	... ...	2½
5	Leech Tabling	3¼
		8½

JIB-HEADED TOPSAIL.

The allowances for the stretching of the gores are at the same rate as for the foresail, and are arrived at by the same method.

This sail differs only in respect to the centre of effort being upon the lower angle; therefore the line through the centre must be struck from a square of the foot line, and the calculation made upon the length of line from the foot of sail (*e*) to the star at centre, which is 7 ft. 6 in. The amount to be taken in by the seams and tablings is 7½ in., commencing to widen the seams upon the line leading from *o* to *d* upon the upper, and from *o* to *e* upon the lower part. The hollow at the mast, which is required to act against the wind's pressure at the centre is at the rate of ½ in. per foot of the length of line from the mast to star at centre, which is 8 ft. Add ¼ in. per foot of the length of line from the clew up the leech upon a square of the tack, which is upon this sail 12 ft., making 7 in. as the amount of hollow required.

The seam allowance for the stretching of the gores upon the last is as follows:—

No. of Seams.		Last Seams. Inches.
1	... ...	¼
2	... ...	½
3	... ...	¾
4	... ...	1⅛
5	... ...	1⅜
6	Leech Tabling	3½
		7½

YARD TOPSAIL.

The necessary allowance for the stretching of the gores are as under:—

For the clew the rate is 1 in. per foot of the full last gore, which is 14 ft.; therefore 14 in. is the amount which the seams and tablings need to be taken in, commencing upon the line *b* to *a* upon the upper part and *b* to *c* upon the lower. This allowance is upon a square of the leech and foot lines to the last line. Upon the last line it will give out about 18 in., and the foot of sail at the tack will give out 1 in. per foot of the mast gore, which is 7 ft. The head will stretch but very little, so there is no wide seam needed upon the head. The leech tabling should be creased in about 4 in. to make the allowance required. The head should be rounded at the rate of ¼ in. per foot of the length of the yard. The mast of this sail should be creased straight.

The seam allowance for the stretching of the last gores is as under:—

No. of Seams.		Last Seams. Inches.
1	... ...	⅛
2	... ...	¼
3	... ...	½
4	... ...	¾
5	... ...	1
6	... ...	1¼
7	... ...	1½
8	... ...	1¾
9	... ...	1⅞
10	Leech Tabling	5
		14

JIB.

The allowances needed for the stretching of the gores are for the last gore 1 in. per foot of the same, which is 5 ft. 6 in. This amount is to be taken in by the seams and leech tabling, commencing to widen the seams upon the lines *b* to *a* and *b* to *c*. The giving out of the leech and foot at the head and tack is arrived at by calculating the amount to which the rope will stretch, and deducting the requisite quantity of slack cloth needed to be taken in when sewing the rope on. Calculating the size of the rope at 3¼ in., and allowing for 14 yards, will give a stretching tendency of 45½ in. Taking in the slack canvas per yard as under amounts to 33¼ in., which deducted from the 45½ in., leaves 12¼ in. as the amount of the stretching of the stay.

Rope. Yards.	Slack Cloth. Inches.
1	1¼
2	1¾
3	2¼
4	2½
5	3
6	3¼
7	3½
8	3¼
9	2¾
10	2½
11	2¼
12	2
13	1¾
14	1¼
	33¼

For the flow of the stay the outer line should be extended at the rate of 1½ in. per foot of the last gore beyond a straight line from the tack to head, then by striking a line from the head to foot 8 in. down the head and 4¼ in. inside the tack, which should be the position of the head and tack when the sail is spread, showing the necessary flow to be 11 in.

The seam allowance for the giving out of the last gores at the clew is as follows :—

No. of Seams.	Last Seams. Inches.
1	⅛
2	¼
3	⅜
4	½
5	⅝
6 Leech Tabling	3
	5½

CALCULATION OF THE GORES FOR CUTTER'S MAINSAIL (DIAGONAL-CUT)

UPON 24-IN. CANVAS.

Upper Part.			Lower Part.		
No. of Cloths.	Mast & Head Gores.		Last Gores.		Mast Gores.
	Ft.	In.	Ft.	In.	Inches.
¾	4	0	1	8	2
1	1	3	2	5	3
2	1	2	2	5	3
3	1	0	2	5	2
4		10	2	5	2
5		9	2	5	1
6		8	2	5	1
7		8	2	5	0
8		7	2	5	0
9		7	2	5	1
10		6	2	5	1
11		6	2	5	2
12		5	2	5	2
13		4	2	5	3
14		3	2	5	0
	13	6	35	6	23

The head of this sail does not require so many cloths as the last by one, therefore the ¾ cloth should be cut with a 4-foot gore, and the selvage of the next cloth should overshoot by 9 in.

CALCULATION OF THE GORES FOR YAWL OR KETCH'S MAINSAIL (DIAGONAL-CUT)

UPON 24-IN. CANVAS.

Upper Part.			Lower Part.		
No. of Cloths.	Mast & Head Gores.		Last Gores.		Mast Gores.
	Ft.	In.	Ft.	In.	Inches.
½	1	8	1	1¼	1
1	1	7	2	2¼	2
2	1	5	2	2¼	2
3	1	4	2	2¼	1
4	1	3	2	2¼	0
5	1	2	2	2¼	0
6	1	1	2	2¼	0
7	1	1	2	2¼	0
8	1	0	2	2¼	0
9	1	0	2	2¼	0
10		11	2	2¼	0
11		11	2	2¼	0
12		10	2	2¼	1
13		10	2	2¼	1
14		9	2	2¼	2
15		8	2	2¼	2
	15	10	33	11	12

CALCULATION OF THE GORES FOR FORESAIL (DIAGONAL-CUT)

UPON 24-IN. CANVAS.

Upper Part.			Lower Part.			
No. of Cloths.	Stay Gores.		Last Gores.		Stay Gores.	
	Ft.	In.	Ft.	In.	Ft.	In.
¾	1	5	1	3		11
1	1	9½	1	8	1	3
2	1	9½	1	8	1	3
3	1	10	1	8	1	3½
4	1	10	1	8	1	3½
5	1	10½	1	8	1	4
6	1	10½	1	8	1	4
7	1	11	1	8	1	4½
8	1	11	1	8	1	4½
	16	3	14	7	11	5

CALCULATION OF THE GORES FOR JIB-HEADED TOPSAIL (DIAGONAL-CUT)

Upon 24-in. Canvas.

Upper Part.		Lower Part.			
No. of Cloths.	Mast Gorss.	Last Gores.		Mast Gores.	
	Inches.	Ft.	In.	Ft.	In.
½	4½	1	3	1	2
1	9	2	6½	2	4
2	9	2	6½	2	4
3	9	2	6½	2	4
4	9	2	6½	2	4
5	9	2	6½	2	4
6	9	2	6½	2	4
7	9	2	6½	2	4
	5 7½	19	0½	15	2

CALCULATION OF THE GORES FOR YARD TOPSAIL (DIAGONAL-CUT)

Upon 24-in. Canvas.

Upper Part.			Lower Part.				
No. of Cloths.	Head Gores.		Last Gores.		Head & Mast Gores.		
	Ft.	In.	Ft.	In.	Ft.	In	
¼		5½		4	1	4	Head.
1	1	9½	1	4	5	5	
2	1	9	1	4	5	5	
3	1	8½	1	4		10½	
4	1	8	1	4		10½	
5	1	7½	1	4		10½	
6	1	7	1	4		10½	
7	1	6½	1	4		10½	
8	1	6	1	4		10½	
9	1	5½	1	4		10½	
10	1	5	1	4		10½	
	16	6	13	8	7	1½	

CALCULATION OF THE GORES FOR JIB (DIAGONAL-CUT)

UPON 24-IN. CANVAS.

	Upper Part.		Lower Part.		
No. of Cloths.	Stay Gores. Ft.	In.	Last Gores. Inches.	Stay Gores. Ft.	In.
¾	3	6	8½	1	10½
1	4	9	11½	2	6
2	4	7	11½	2	6
3	4	5	11½	2	6
4	4	3	11½	2	6
5	4	1	11½	2	6
½				1	3
	25	7	5 6	15	7½

DIMENSIONS FOR CUTTING OUT CUTTER'S MAINSAIL (DIAGONAL-CUT).

	Lower Part.			Upper Part.				
No. of Cloths.	Mast Gores. Inches.	Last Gores. Ft.	In.	Last Seams. Inches.	Mast and Head Gores. Ft.	In.	Head Seams. Inches.	Slack Seams. Inches.
¾	2	1	8	1⅜	4	0 M. Gore		
1	3	2	5	1⅜	1	3	1¾	
2	3	2	5	1⅜	1	2	1⅞	
3	2	2	5	1⅜	1	0	2	
4	2	2	5	1⅜		10	2⅛	
5	1	2	5	1⅝		9	2¼	
6	1	2	5	2⅛		8	2⅜	
7	0	2	5	2½		8	2½	
8	0	2	5	2⅞		7	2⅝	2
9	1	2	5	3¼		7	2¾	3
10	1	2	5	3⅝		6	2⅞	4½
11	2	2	5	4		6	3	6
12	2	2	5	4⅜		5	3⅛	7
13	3	2	5	4¾		4	3⅛	8½
14	0	2	5	5 L. T.		3	3 L. T	8

DIMENSIONS FOR CUTTING OUT YAWL OR KETCH'S MAINSAIL (DIAGONAL-CUT).

	Lower Part.				Upper Part.			
No. of Cloths.	Mast Gores.	Last Gores.		Last Seams.	Mast and Head Gores.		Head Seams.	Slack Seams.
	Inches.	Ft.	In.	Inches.	Ft.	In.	Inches.	Ionhes.
½	1	1	1¼	1⅜	1	8 M. Gore	1⅜	
1	2	2	2¼	1⅜	1	7	2⅛	
2	2	2	2¼	1⅜	1	5	2⅝	
3	1	2	2¼	1⅜	1	4	2¾	
4	0	2	2¼	1⅜	1	3	2⅞	
5	0	2	2¼	1⅜	1	2	3	
6	0	2	2¼	1¾	1	1	3⅛	
7	0	2	2¼	2⅛	1	1	3¼	
8	0	2	2¼	2⅝	1	0	3⅜	½
9	0	2	2¼	3	1	0	3½	1
10	0	2	2¼	3⅜		11	3⅝	1½
11	0	2	2¼	3¾		11	3¾	2
12	1	2	2¼	4⅛		10	3⅞	3
13	1	2	2¼	4½		10	4	4
14	2	2	2¼	4⅞		9	4⅛	5
15	2	2	2¼	5¼ L. T.		8	5¾ L. T.	5

DIMENSIONS FOR CUTTING OUT FORESAIL (DIAGONAL-CUT).

	Upper Part.				Lower Part.		
No. of Cloths.	Stay Gores.		Laet Gores.		Last Seams.	Stay Gores.	
	Ft.	In.	Ft.	In.	Inc' es.	Ft.	In.
¾	1	5	1	3	1¼		11
1	1	9½	1	8	1¼	1	3
2	1	9½	1	8	1¼	1	3
3	1	10	1	8	1¼	1	3½
4	1	0	1	8	1⅝	1	3½
5	1	10½	1	8	2⅛	1	4
6	1	10½	1	8	2¾	1	4
7	1	11	1	8	3¼	1	4½
8	1	11	1	8	3¾ L. T.	1	4½

DIMENSIONS FOR CUTTING OUT JIB-HEADED TOPSAIL (DIAGONAL-CUT).

	Upper Part.		Lower Part.	
No. of Cloths.	Mast Gores.	Last Gores.	Last Seams.	Mast Gores.
	Inches.	Ft. In.	Inches.	Ft. In.
½	4½	1 3	1	1 2
1	9	2 6½	1	2 4
2	9	2 6½	1¼	2 4
3	9	2 6½	1⅝	2 4
4	9	2 6½	2	2 4
5	9	2 6½	2⅜	2 4
6	9	2 6½	2¾	2 4
7	9	2 6½	5 L. T....	0 0

DIMENSIONS FOR CUTTING OUT YARD TOPSAIL (DIAGONAL-CUT).

	Upper Part.		Lower Part.		
No. of Cloths.	Head Gores.	Last Gores.	Last Seams.	Head & Mast Gores.	
	Ft. In.	Ft. In.	Inches.	Ft. In.	
¼	5½	4	1	1 4	Head.
1	1 9½	1 4	1⅛	5 5	
2	1 9	1 4	1¼	5 5	
3	1 8½	1 4	1½	10½	
4	1 8	1 4	1¾	10½	
5	1 7½	1 4	2	10½	
6	1 7	1 4	2¼	10½	
7	1 6½	1 4	2½	10½	
8	1 6	1 4	2¾	10½	
9	1 5½	1 4	2⅞	10½	
10	1 5	1 4	5 L. T....	10½	

DIMENSIONS FOR CUTTING OUT JIB (DIAGONAL-CUT).

	Upper Part.			Lower Part.		
No. of Cloths.	Stay Gores.		Laet Gores.	Laet Seams.	Stay Gores.	
	Ft.	In.	Inches.	Inchee.	Ft.	In.
¾	3	6	8½	⅞	1	10½
1	4	9	11½	1	2	6
2	4	7	11½	1⅛	2	6
3	4	5	11½	1¼	2	6
4	4	3	11½	1⅜	2	6
5	4	1	11½	3⅝ L. T.	2	6
				½ Cloth	1	3

ROPING OF CUTTER'S MAINSAIL (DIAGONAL-CUT).

The mast should be treated according to the class of the vessel, as the size of the rope, and the manner of putting it on, materially depend thereon.

The size of the head rope is 1⅞ in., which should be calculated as to its stretching tendency, viz., 1⅞ in. per yard of length. Reckoning 7 yards of rope, which will give out 13⅛ in., and deducting it from the amount of the stretching of the gores, viz., 17½ in., and allowing 1 in. for the giving-out of the mast rope upon the head, will give the amount of slack rope required—3⅜ in.—to be put on as under :—

Rope.	Slack Rope.
Yards.	Inches.
1	⅞
2	¾
3	⅝
4	½
5	⅜
6	¼
7	0
	3⅜

If a leech rope is put on, it should be at the rate of a $\frac{1}{4}$ in. per yard of slack rope.

The size of the clew rope is $4\frac{3}{4}$ in., which, when over the splice, should be commenced even, and gradually tightened so that the last yard at the clew has $1\frac{3}{4}$ in. of slack cloth.

The foot rope must be sewn on slack.

ROPING OF YAWL OR KETCH'S MAINSAIL (DIAGONAL-CUT).

The mast and head should be treated in the manner already described for the cutter's mainsail.

The size of the leech rope should be 3 in., and sewn on even.

The size of the clew rope is 5 in., and should, when over the splice, be commenced even, and gradually tightened until the last yard has 2 in. of slack cloth.

ROPING OF FORESAIL (DIAGONAL-CUT).

The size of the stay rope is $2\frac{1}{2}$ in., and must be sewn on, commencing the first yard with 2 in. of slack cloth, gradually decreasing the amount of slack per yard until the last yard is even.

The size of the leech rope is $1\frac{3}{4}$ in., and should be sewn on at the rate of $\frac{1}{2}$ in. of slack rope per yard of the sail.

The size of the clew rope is 3 in., and should, when over the splice, be commenced even, and gradually tightened until the last yard has 1 in. of slack cloth. The foot rope must be sewn on slack.

ROPING OF JIB-HEADED TOPSAIL (DIAGONAL-CUT).

The size of the mast rope is 2¾ in., and must be commenced even at the tack, gradually tightened so that the centre yard has 2 in. of slack cloth, then diminishing the same until the last yard has ½ in. slack cloth.

The size of the leech rope is 1¾ in., and must be sewn on at the rate of ½ in. per yard of slack rope.

The size of the clew rope is 2¾ in., and should be commenced a little slack and brought even at the clew.

The foot rope is 1¾ in., and must be sewn on slack.

ROPING OF YARD TOPSAIL (DIAGONAL-CUT).

The size of the mast rope is 2¾ in., to be sewn on at the rate of ½ in. of slack cloth per yard of rope.

The size of the head rope is 1½ in., which should be put on as under :—

Rope. Yards.	Slack Rope. Inches.
1	1
2	1
3	1
4	1
5	1
6	1
7	¾
8	¾
9	½
10	½
11	¼
12	0
	8¾

The size of the clew rope is 2½ in., which must be sewn on even.

ROPING OF JIB (DIAGONAL-CUT).

The size of the stay rope is $3\frac{1}{4}$ in., to be sewn on as follows:—

Rope. Yards.	Slack Cloth. Inches.
1	$1\frac{1}{4}$
2	$1\frac{3}{4}$
3	$2\frac{1}{4}$
4	$2\frac{1}{2}$
5	3
6	$3\frac{1}{4}$
7	$3\frac{1}{2}$
8	$3\frac{1}{4}$
9	$2\frac{3}{4}$
10	$2\frac{1}{2}$
11	$2\frac{1}{4}$
12	2
13	$1\frac{3}{4}$
14	$1\frac{1}{4}$
	$33\frac{1}{4}$

The size of the leech rope is $1\frac{3}{4}$ in., to be sewn on even.

The size of the clew rope is 3 in., which should be commenced a little slack and brought even at the clew.

The foot rope is $1\frac{3}{4}$ in., to be put on slack.

CHAPTER XI.

ON HORIZONTAL-CUT SAILS.

CUTTERS, MAINSAIL AND FORESAIL—CALCULATION OF GORES—NECESSARY ALLOWANCES—ROPING, &c.—REMARKS THEREON.

CALCULATION OF GORES FOR MAINSAILS (HORIZONTAL CUT).

12-IN. CANVAS.

No. of Clothe.	Leach.	Head.		Mast.	No. of Clothe.	Leach.	Head.		Mast.	Foot.	
	In.	Ft.	In.	In.		In.	Ft.	In.	In.	Ft.	In.
1	2½	2	7		22	0	...		5		
2	2¼	2	5		23	¼	...		6		
3	2	2	2		24	¼	...		6		
4	1¾	2	0		25	½	...		7		
5	1½	1	10		26	½	...		7		
6	1½	1	10		27	½	...		7		
7	1¼	1	9		28	½	...		8		
8	1	1	9		29	¾	...		8		
9	1	1	9		30	¾	...		...	2	5
10	¾	...		7	31	¾	...		...	2	5
11	¾	...		7	32	¾	...		...	2	5
12	¾	...		7	33	1	...		...	2	5
13	½	...		6	34	1	...		...	2	4
14	½	...		6	35	1	...		...	2	4
15	½	...		6	36	1	...		...	2	4
16	½	...		5	37	1¼	...		...	2	4
17	¼	...		5	38	1¼	...		...	2	3
18	¼	...		4	39	1½	...		...	2	3
19	0	...		4	40	1¾	...		...	2	3
20	0	...		4	41	2	...		...	2	2
21	0	...		5							

NECESSARY ALLOWANCES.

FOR the stretching the leach shows 24 in. round. The seams should be widened from straight line of peak to sheet, at the rate of 6 in. per foot of round; this therefore needs 12 in. taken in by seams.

Head and foot seams require to be creased wider at gores, at the rate of ½ in. per foot of gore. Head showing 8 ft. gore, foot 28 ft.

For stretching upon spars ¾ in. per foot of gore on head and foot—this gives head 13½ in., foot 21 in. The head needs to be rounded ¼ in. per foot of length—which is 20 in., giving 5 in. hollow to mast at the rate of ¼ in. per foot of width at line of throat—foot straight, with exception of end—at sheet turned up 2 in. and tack likewise. Body seam reckoned at ½ in.

ROPING.

Mast rope 2¼ in., to be put on as under:—

Rope. Yards.				Slack Cloth. Inches.
1	...	...	...	2¾
3	...	...	...	2½
2	...	...	...	2¼
4	...	...	...	2
5	...	...	...	1¾
6	...	...	...	1½
7	...	...	...	1¼

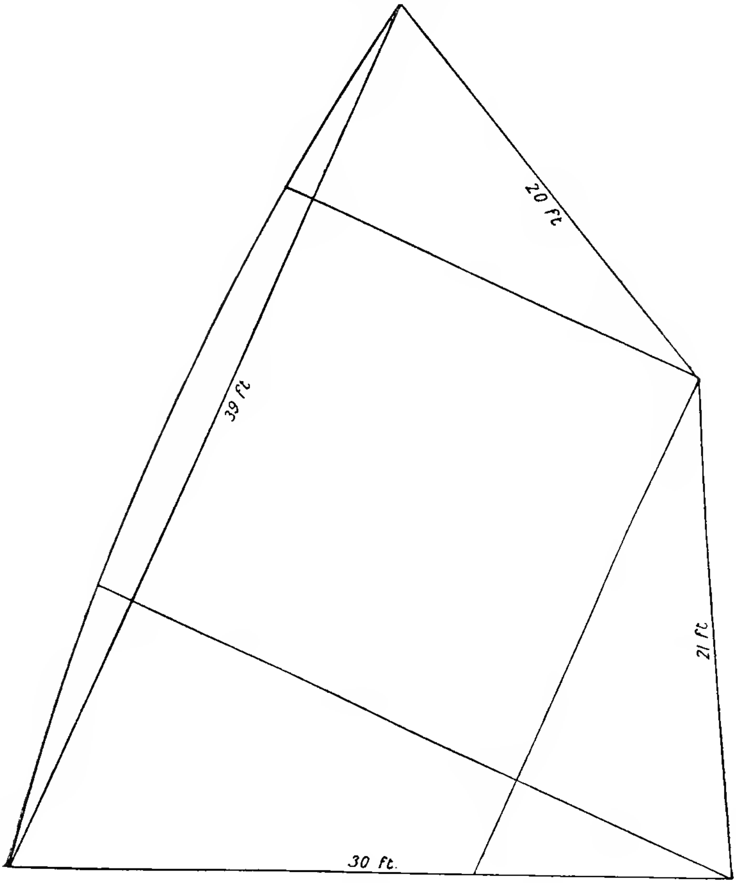
Head rope, size 1½ in., to be put on even at throat to steady at peak.

Clew rope, size 2 in., starting trifle slack (rope to steady at clew).

Foot rope, size 1½ in., to be put on about ¼ in. slack rope per yard of sail.

Fig. 24.—MAINSAIL (horizontal cut).

(Scale, $\frac{1}{8}$ in. per foot.)



CALCULATION OF GORES FOR FORESAIL (HORIZONTAL CUT).

No. of Cloths.	Leech. Inches.	Stay. Inches.
1	1¾	8
2	1½	8
3	1¼	8
4	1	7
5	¾	7
6	¾	7
7	½	7
8	¼	6
9	½	6
10	¼	6
11	¼	6
12	0	6
13	0	6
14	0	7
15	¼	7
16	¼	7
17	½	7
18	½	8
19	¾	8
20	1	8
21	1¼	8
22	1½	8

Foot cloth 6 in. at tack to nothing at sheet.

NECESSARY ALLOWANCES.

Leach 9 in. round—seams to be widened 4½ in. from line of head to sheet.

Hollow to stay—4¼ in. per foot of width at centre.

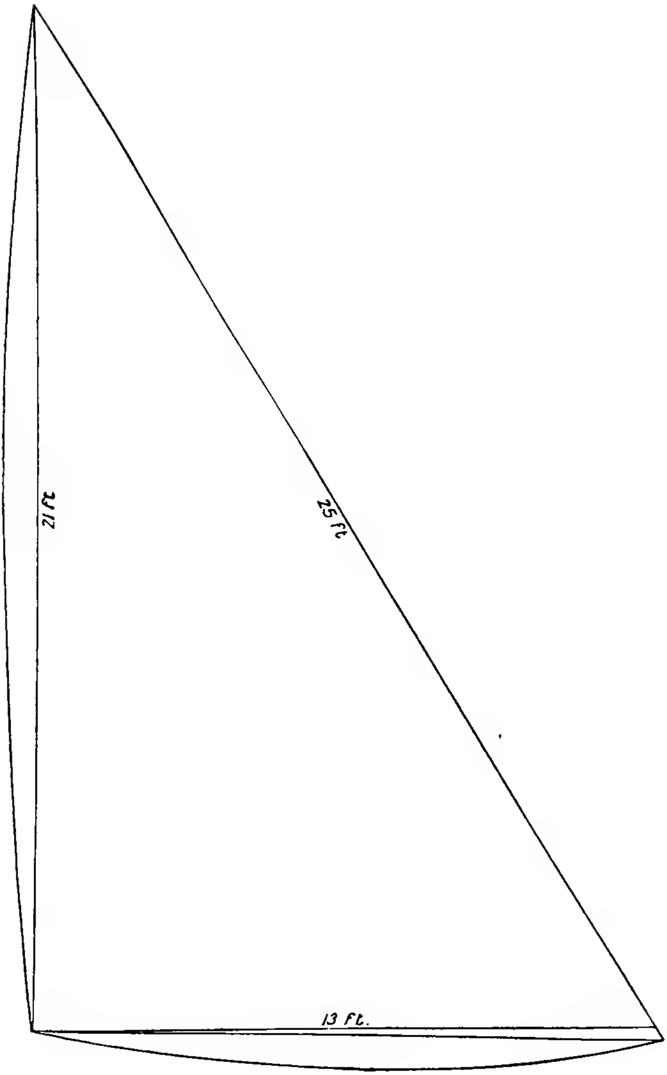
ROPING.

Stay rope, size 2¼ in., to be put on as under:—

Yards.	Slack Cloth. Inches.
1	2¼
2	2
3	1¾
4	1¾
5	1½
6	1½
7	1¼
8	1
½	½

Fig. 25.—FORESAIL (horizontal cut).

(Scale, $\frac{1}{4}$ in. per foot.)



CHAPTER XII.

CONCLUDING REMARKS.

Need of Care in the Manufacture of Sails—Good Workmanship Essential—Creasing Wide Seams—Proportion of Allowances—The "Science" and "Art" of Sailmaking.

Great care should be exercised in the manufacture of all fore and aft sails throughout; and even those things which are deemed by some sailmakers very trivial should be carefully treated. Carelessness and indifference in this respect will do much to spoil the effect of a sail, however near and true the calculations may have been.

The rudimentary part of the art of sailmaking has not been dealt with to any great extent in this treatise. At the same time, it cannot be denied that good workmanship is most essential to the production of a good sail. For instance, the holes that are worked upon the head, mast, foot, etc., of a sail, should be worked at the same depth from the edge, one with the other. Holes for the cringles at the corners should be worked fair with the angle of strain, and each part bear a proportionate strain. When sewing over the splices of ropes, they should be treated so that when strain is applied they shall be fair with the sail, and not turn over or under. When sewing over the big end of a splice, it should be turned out long-jawed, and gradually rounding in again until over the splice. If working from the small end, as upon the clew rope, the splice should be gradually thrown over upon the sail, so that the rope is made longer jawed until clear of the splice, then gradually bring it back until the rope is fairly rounded in again. All linings and tablings should be of the same thread as the sail, at the parts to which they are attached.

It is absolutely necessary that the position of the throat and tack of a mainsail be determined before the creasing of the wide seams can be properly done. The same may be said as regards the sheet of a jib and all sails that are cut down from the sheet. It is the best plan, when creasing the wide seams, to use a board or dresser, so that the cloth can be laid out to the full length of seam required. The cloth can then be pinned down to the board with a small pricker at the width of the body seam, where the wide seam commences. Another pricker should then be inserted at the first seam mark at width of calculation. For instance, upon the foot of mainsail it should be evenly creased from pricker to pricker, after which the first pricker can be used to pin down the width of the seam required at foot. This will be found a great improvement to treating the seam upon the bench.

To get the true length of the foot of a mainsail which has a round, it should be spread upon the floor to get a straight line from the tack to clew, when it should be picked up and measured upon that line with a yard-stick.

The first three mainsails that are mentioned in this work have been treated as racing yacht sails. If no leech ropes are used, the tabling should be turned in 4 times thick for a large sail, and 3 times for a smaller one, which must be well stitched, but the twine not drawn tight. A restraining line, fitted within the leech tabling, may be of some benefit in steadying the leech of a mainsail when damp. When putting in, sufficient room must be allowed for its working, or it will prove more detrimental than otherwise.

The proportion of allowances given for the roping of these sails is as great as is required for any sail. For smaller racing yachts the same proportion of allowance of cloth per yard of rope should be made, reducing the amount of slack cloth in like manner as the size of the rope in circumference.

The mast rope of mainsails, for the class of vessels that use the main tack but little, should not be sewn on so tightly; but stay ropes of jibs, which are not attached to a stay, should be treated as those given in Chapter VI. upon Allowances.

There is no reason why all merchant vessels should not have sails of the best manufacture, as the percentage of risk is not so great, and there is not so much strain upon the vessel. The best sails, also, add to the sailing qualities of a vessel, and being fair they bear a proportionate strain throughout, therefore lasting much longer than uneven ones, and costing no more in their manufacture.

There are many sails of various shapes the names of which are not mentioned in this work. The reason is that if all sails had been treated upon, much unnecessary matter—so far as the art and science of the trade is concerned—would have been given.

To give satisfaction, all sails must be manufactured upon the principle laid down in this book. The "science" of the trade is in getting out a geometrical plan of the sail required; finding therefrom the centre of effort, where the force of the wind is supposed to be collected, and obtaining the angles of strain; and finally, squaring the sail from the after leeches, thus finding the position of strains in relation to the threads of the canvas, and thereby being able to calculate the allowances needed for the stretching of the gores upon such parts as are affected by the wind, &c.

The "art" of the trade is in dealing with the knowledge thus gained, and in the general work of manufacture. Much skill is necessary in all branches of the trade, but any sailmaker who is able to properly produce a fore and aft sail can make ships' square sails, as they are more simple of construction.

UNWIN BROTHERS, LIMITED, THE GRESHAM PRESS, WOKING AND LONDON.

Thomson's Yacht Canvas.

M. C. THOMSON & CO., LTD.,

SAIL-CLOTH MANUFACTURERS,

Works:
Wardmill, Arbroath.

25, Hope Street &
98, Holm Street, GLASGOW,
1a, Bow Lane, LONDON,

- Make a Speciality of -

YACHT SAIL-CLOTHS

of every description.

FLAX, EGYPTIAN & AMERICAN COTTON, SILK,

in 12, 15, 18, 24 & 36 inch widths.

Sole Makers of the World Renowned "HURRICANE" CANVAS.

Tarpaulin and Waterproof Canvas a Speciality.

Patterns and Prices on Application.

BINKS BROTHERS,

Established 1835.

MAKERS OF ALL DESCRIPTIONS OF

STEEL & IRON WIRE ROPES,

AND GALVANIZERS.

MILLWALL, LONDON, E.

Yachts' Rigging fitted complete ready to send aloft.

ALL KINDS OF IRONWORK GALVANIZED.

HENRY BANNISTER & CO.,

Yacht Rope Manufacturers,

ESTABLISHED 1820.

COWES, I.W.

Contractors to Admiralty, War Office, Board of Trade.

* * *

SPECIALITIES:—

Finest Yacht Manilla,

Hemp & Italian Rope,

all of the highest class and made from specially selected imported Hemp.

BOLT ROPE OF HEMP OR ITALIAN,

Lightly Tarred by Special Process.

Orders of any description can be executed promptly.

DYNE & EVENS,

York Road, Limehouse, LONDON, E.

Yacht Blocks and Sheaves,

In Ash, Boxwood, and Lignum Vitæ.

= Also in Gun-Metal and Galvanized Iron. =

Makers of DYNE'S PATENT YACHT BLOCKS.

WORKS ON

Shipbuilding, Marine Engineering, ... Navigation, etc.

Marine Engines and Boilers. Their Design and Construction. By Dr. G. Bauer. Translated from the German by E. M. Donkin and S. B. Donkin, Edited by L. S. Robertson, M.Inst.C.E. Medium 8vo, cloth . . *Net* **25/-**

The Naval Architect's and Shipbuilder's Pocket-Book of Formulæ, Rules, and Tables, and Marine Engineer's and Surveyor's Book of Reference. By C. Mackrow . . . . *Net* **12/6**

Wannan's Marine Engineer's Guide to Board of Trade Examinations for Certificates of Competency. By A. C. Wannan and E. W. I. Wannan. 8vo, cloth . . . . *Net* **10/6**

Wannan's Marine Engineer's Pocket-Book. By A. C. Wannan. 18mo, leather **5/-**

Marine Engines and Steam Vessels. By R. Murray and G. Carlisle. Crown 8vo, cloth **4/6**

Elementary Marine Engineering. A Manual for Young Marine Engineers and Apprentices. By J. S. Brewer **1/6**

Chain Cables and Chains. By T. W. Traill, F.E.R.N., M.Inst.C.E. Folio, cloth . . . . **. £2 2s.**

The Shipbuilding Industry of Germany. By G. Lehmann-Felskowski. Super-royal 4to, cloth . . . . *Net* **10/6**

Ships and Boats. By W. Bland. Crown 8vo, cloth **1/6**

Ships for Ocean and River Service, Principles of the Construction of. By H. A. Sommerfeldt. Crown 8vo, cloth **1/6**

An Atlas of Engravings to Illustrate above. 4to, cloth . . . **7/6**

Naval Architecture. An Exposition of the Elementary Principles. By J. Peake. Crown 8vo, cloth **3/6**

The Art and Science of Sailmaking. By S. B. Sadler. 4to, cloth, **12/6**

Sails and Sail-Making. With Draughting, and the Centre of Effort of the Sails. By R. Kipping, N.A. Crown 8vo, cloth **2/6**

Masting, Mast-Making, and Rigging of Ships. By R. Kipping, N.A. Crown 8vo, cloth **2/-**

Sea Terms, Phrases, and Words. English-French, French-English. By W. Pirrie. Fcap. 8vo, cloth **5-**

Sailor's Sea Book: A Rudimentary Treatise on Navigation. By J. Greenwood and W. H. Rosser. Crown 8vo, cloth **2/6**

Practical Navigation. By J. Greenwood and W. H. Rosser. 12mo, half-bound **7/-**

Navigation and Nautical Astronomy, in Theory and Practice. By Prof. J. R. Young. Crown 8vo, cloth **2/6**

Mathematical Tables, for Trigonometrical, Astronomical, and Nautical Calculations. By H. Law and J. R. Young. Crown 8vo **4/-**

London: CROSBY LOCKWOOD & SON, 7, Stationers' Hall Court, E.C.